SAMPLING AND ANALYSIS PLAN

Libby Owens Ford Plant

Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Triad Project Number 04-10-0052

Submitted to:

West Virginia Department of Environmental Protection
Office of Environmental Remediation
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Charleston, West Virginia 25304

Submitted by:

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July 28, 2010

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ACRONYM GLOSSARY

AOC	Area of Concern
AOPC	Area of Potential Concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CLASS	Contract Laboratory Analytical Support Services
CLP	Contract Laboratory Program
CLASS	Contract Laboratory Analytical Support Services
CLP	Contract Laboratory Program
CoC	Chain-of-custody
COPC	Contaminant of Potential Concern
DI	Deionized
DOT	Department of Transportation
DQO	Data Quality Objectives
FOM	Field Operations Manager
FORMS II Lite	Field Operations and Records Management System II Lite
FSP	Field Sampling Plan
GPS	Global Positioning System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operation and Emergency Response
H&S	Health and Safety
HRS	Hazard Ranking System
HSO	Health and Safety Officer
IATA	International Air Transport Association
IDW	Investigative derived waste
MS/DUP	Matrix Spike/Matrix Duplicate
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NPL	National Priority List
OER	Office of Environmental Remediation
OSHA	Occupational Safety and Health Administration
PM	Project Manager
PO	Project Officer
PPE	Personnel protective equipment
QAPP	Quality Assurance Project Plan
QA	Quality Assurance
QAO	Quality Assurance Officer
QC	Quality Control
RAS	Routine Analytical Services
RAGS	*Risk Assessment Guidance for Superfund*
RPD	Relative Percent Deviation
RSCC	Regional Sample Control Center

RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
SIR	Site Inspection Reassessment
SOW	Statement of Work
TR	Traffic Report
Triad	Triad Engineering, Inc.
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VRRDA	West Virginia Voluntary Remediation and Redevelopment Act
WVDEP	West Virginia Department of Environmental Protection

1.0 INTRODUCTION

Triad Engineering, Inc. (Triad) received a purchase order from the West Virginia Department of Environmental Protection (WVDEP), Office of Environmental Remediation (OER) on March 1, 2010 to perform various investigatory tasks relative to the Libby Owens Ford Plant Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Site under a Pre-Remedial Cooperative Agreement between the United States Environmental Protection Agency (USEPA) and the WVDEP.

The Libby Owens Ford Plant Site (the Site) has Comprehensive Environmental Response, Compensation, and liability Information System (CERCLIS) site designation WVD005008412. The current CERCLA status is Active with "Site Reassessment Start Needed." The Site is currently not on the National Priorities List (NPL). The USEPA and WVDEP, OER determined a Site Inspection Reassessment (SIR) was warranted to assess potential risk associated with the Site and has determined the Site should undergo further investigation under CERCLA.

This *Sampling and Analysis Plan* (SAP) has been prepared under Task 1 of the approved Work Plan, WVDEP Purchase Order DEP14980, and is to be reviewed and approved by the WVDEP, OER Project Manager (PM). The *SAP* consists of a site specific *Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP*), and *Health and Safety Plan (HASP).* This *SAP* has been prepared in accordance with USEPA *Guidance for Quality Assurance Project Plans (EPA QA/G-5)* and *Data Quality Objectives Process for Superfund*. This *SAP* utilized guidance and memoranda prepared by USEPA Region III regarding data validation requirements and health and safety in accordance with the requirements of 29CFR1910.120.

1.1 Sampling Objectives

The objective of this SAP is to generate data of sufficient quality and quantity to achieve the following:

- Calculate a Hazard Ranking System (HRS) site score;
- Determine if contamination is present at the Site;
- Determine if contamination is migrating off the Site; and
- Provide recommendations to the WVDEP and USEPA regarding the need for further action at the Site.

1.2 Site Location

The Libby Owens Ford Plant CERCLIS Site is located at 57th Street and MacCorkle Avenue in Charleston, Kanawha County, West Virginia. Coordinates for the approximate center of the Site are 38° 18' 43.9''north latitude and 81° 34' 5.48''west longitude. The Site is depicted on the 1976 *Charleston East W.VA. United States Geological Survey* (USGS) 7.5-minute topographic quadrangle map and is presented on the attached **Figure 1, *Site Location Map.***

1.3 Site Description

The Libby Owens Ford Plant (LOF) was a window glass manufacturing plant that operated from 1917 to 1980 on approximately 25 acres on the southern side of MacCorkle Avenue. This area is now occupied by the Kanawha Mall, Kroger, two banks (Chase and BB&T), several restaurants (including Burger King, Applebee's, Taco Bell, and La Caretta), and several retail stores (including a hair salon, movie store, and smoker friendly).

LOF also had an easement from the plant area to the Kanawha River along the Owens Illinois (OI) glass container plant. The Owens Illinois glass container plant operated from the early 1920's to the 1960's on approximately 37 acres on the northern side of MacCorkle Avenue. This area is now occupied by Lowes, several restaurants (including Cracker Barrel, Arby's, Pizza Hut), and a large warehouse. The West Virginia Housing Development Fund has entered 2.08 acres at the southwest corner of the area into the West Virginia Voluntary Remediation Program (WVVRP). It has also been reported that the 4.04 acre parcel currently owned by Emerald Coast Hospitality on the eastern portion of the area will also be entered into the WVVRP.

General Site and surrounding area conditions are depicted on the Google 2009 aerial photograph on the attached **Figure 2, *Aerial Photograph***. The Site is bound to the immediate north, northeast by the Kanawha River. The Site is bound to the immediate southwest by a CSX railway. The Site is bound to the immediate northwest by 57th Street, further west are residential and commercial properties. The Site is bound to the immediate southeast by Interstate 77.

1.4 Areas of Potential Concern

There are three known LOF waste disposal areas of concern (AOC) that have been identified at the Site. Area 1 is an approximate one acre waste disposal area that was located behind one of the glass furnaces in the back of the LOF plant (behind current Kanawha Mall). Area 2 is an approximate five acre waste disposal area located along the Kanawha River. Area 3 is an approximate 10 acre waste disposal area located near/under the Interstate 77 interchange. The exact locations, amount of waste disposed, and waste boundaries are unknown. The approximate locations of these areas are depicted on the attached **Figure 2, *Aerial Photograph.*** The disposal areas were reportedly used from 1917 until 1980 and primarily consisted of used furnace refractories, unusable glass batch materials, and cullet. Waste was also reportedly disposed of in Owens Industrial Park. It is unknown if this reference is to Area 2 or Area 3, or if it is an alternate waste disposal location. The entire Site has been identified as an area of potential concern (AOPC).

1.5 Purpose and Scope

The field work described within this SAP includes collection of soil and aqueous samples at the Libby Owens Ford Plant CERCLIS Site from the following environmental media:

- Surface Soil
- Subsurface Soil
- Groundwater

Sampling procedures are discussed in the *Field Sampling Plan* (*FSP*) portion of this *SAP*. Data quality objectives are outlined in the *Quality Assurance Project Plan (QAPP)* portion of this *SAP*.

2.0 FIELD SAMPLING PLAN (FSP)

2.1 Project Organization

The Project Manager (PM) for this project is [redacted]. Personnel implementing the *FSP* will be selected by the PM. Decisions regarding project scope, sampling locations and collection equipment, or other project related issues, will be made by the PM.

The Quality Assurance Office (QAO) for this project is [redacted]. The level of Quality Assurance (QA), QA procedures, and overall *Quality Assurance Project Plan* (QAPP) development is the responsibility of the QAO. All decisions regarding the QAPP and related issues will be made by the QAO, or at a minimum, in consultation with the QAO.

The Field Operations Manager (FOM) for the project is [redacted]. Implementation of the *FSP* and the *QAPP* at the Site is the responsibility of the FOM. Field level decisions not affecting project quality will be made by the FOM. Real-time assessment of the *QAPP* and recommendations for revisions will be made by the FOM to the QAO.

The Health and Safety Officer (HSO) for the project is [redacted]. Preparation of the *Health and Safety Plan (HASP)*, selection of personal protective equipment (PPE), Health and Safety record keeping, and evaluation of *HASP* effectiveness are the responsibility of the HSO. Please refer to **Appendix 1, *Health and Safety Plan***.

2.2 Sample Type and Locations

The sample type and locations are summarized in **Table 1, *Sampling and Analysis Summary*** and are depicted on **Figure 3, *Sample Location Map*.**

2.3 Sampling Procedures

Overall, sampling procedures will be performed in substantial compliance with the following:

- *Compendium of ERT Soil Sampling and Surface Geophysics Procedures,* EPA/540/P-91/006.
- *Compendium of ERT Groundwater Sampling Procedures*, EPA/540/P-91/007.
- *Contract Laboratory Program Guidance for Field Samplers (Draft-Final)* EPA-540-R-00-003 (January 2004).
- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition (SW-846) Method 5035 Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples*.

The minimum sample volume, container type, preservative, and technical holding time of each media (i.e. solid or aqueous) and analytical request are summarized in **Table 4, *Field Sample Container Requirements*** and **Table 5, *Sample Container Types***. Detailed sampling procedures are provided in **Appendices 2** through **7** of this *SAP*.

2.3.1 Surface Soil

Triad will collect approximately 19 surface soil samples during site assessment activities. Surface soil sampling procedures are provided in **Appendix 2, *Surface Soil Collection Procedure***. Surface soil samples will be collected as follows:

- One background surface soil sample; and
- Eighteen surface soil samples from throughout the Site.

2.3.2 Subsurface Soil

Subsurface soil will be collected via direct-push technology at approximately 19 locations. The depths of soil boring termination will be determined during field investigations. Sampling procedures for subsurface soil collection are provided in **Appendix 3, *Direct-Push Subsurface Soil Collection Procedure*** and **Appendix 4, *Method 5035 Sample Collection Procedure.*** Subsurface soil samples will be collected as follows:

- One background direct push subsurface soil sample; and
- Eighteen direct push subsurface soil samples from throughout the Site;

2.3.3 Groundwater Sampling

Triad will collect approximately nine groundwater samples during site assessment activities using direct-push technology. Collection procedures are provided in ***Appendix* 5, *Direct-Push via Check Valve Groundwater Collection Procedure,*** **Appendix 6, *Aqueous VOC Sample Collection***, and **Appendix 7, *Dissolved Metals Aqueous Sample Collection***. Groundwater samples will be collected as follows:

- Nine on-Site groundwater samples.

2.4 Paperwork Requirements

Paperwork requirements for the contract laboratory program (CLP) review procedures are summarized in the *Users' Guide for Acquiring Analytical Services, Region III Client Services Team* (June 1999). In accordance with OER recommendations, Triad will utilize the USEPA Field Operations and Records Management System II Lite (FORMS II Lite) computer program to prepare, track, and manage field sampling documentation. CLP paperwork requirements will be performed as detailed in the *QAPP*, Section 3.5.

2.5 Analytical Procedures

The samples will be analyzed for the parameters identified in **Table 1, *Sampling and Analysis Summary*** of the *SAP*. The samples will be analyzed according to the method requirements specified in the current Superfund CLP Statement of Work (SOW) and USEPA SW-846 methods as applicable.

2.6 Quality Control Requirements

Field and sample matrix quality control (QC) will be performed as detailed in the *QAPP*. Field QC samples will be collected during the work to assess sampling precision, potential cross-contamination, and matrix effect as summarized in **Table 7, *Field and Matrix QC Samples***.

2.7 Assessment and Oversight

2.7.1 Assessment of field sampling and response actions

The FOM will constantly assess and evaluate the QA system and QC practices during the course of the project. If at any time it becomes apparent that these are not adequate to ensure collection of data of the quality required, the FOM may discontinue the project until sufficient revisions can be made. Such revisions may be made in the field at the direction of the FOM, and noted by the FOM in the field log book, or may be recommended to the PM for implementation by the PM. The PM will review any such revisions with the QAO.

2.7.2 Reports to management

If, in the opinion of the FOM, sufficient adjustment cannot be made to QC practices in the field, the FOM will report these findings to the PM, and discontinue data collection under the current QA system. The PM, in consultation with the FOM and the QAO, will revise the QA system as necessary to ensure that data of adequate quality are obtained.

2.8 Investigative Derived Waste (IDW)

Triad shall manage IDW during field operations in compliance with the USEPA, *Management of Investigation-Derived Waste During Site Inspections* (EPA/540/G-9/009). In addition, we will manage IDW in accordance with directives of the WVDEP as follows:

1) All waste containers, bags or drums, will have a label reading "This Container on Hold Pending Analysis." Write on the label, under the contents section, "Potential Hazardous Waste" (decon/purge water, cuttings, soil etc.) and "Accumulation Start Date" (date the waste is placed in the container). Fill out the rest of the label and place it on the container.
2) Properly secure the lid to the drum or if it is a waste bag, place the bag on plastic and cover the bag with plastic.
3) IDW will also be analyzed for hazardous characteristics as defined by RCRA. Consult with the Triad PM for the appropriate analytical scope to characterize the waste prior to laboratory submittal.
4) If determined to be hazardous, the waste transportation and disposal will be the responsibility of the WVDEP. If not hazardous, TRIAD will return the IDW to the Site, with the approval of the property owner, and remove the IDW containers from the Site.

2.9 Project Schedule

Triad estimates three days in the field with a crew of three personnel in order to complete the Site investigation activities. The work is currently scheduled for the fourth fiscal quarter 2010 (July, August, September). Laboratory analytical results will be requested on a 7 day turn-around time. Quality assurance assessments will be performed by the USEPA within 21 days of receiving the laboratory results. Scheduling changes can only be approved by the WVDEP, OER Project Manager or the USEPA Region III Project Manager.

2.10 Field Equipment

Field equipment will be maintained in accordance with each respective instrument manufacturer's operating instructions. The maintenance activities will be recorded in a logbook. For field equipment, the preventive maintenance information found in **Table 8, *Preventative Maintenance – Field Equipment*** will be utilized.

Field equipment will also be calibrated following the manufacture's procedures and/or specifications. For field equipment, the calibration frequency, acceptance limits, and corrective action information found in **Table 9, *Calibration and Corrective Action – Field Equipment*** will be utilized.

3.0 QUALITY ASSURANCE PROJECT PLAN (QAPP)

3.1 Project Organization

The Project Manager (PM) for this project is [redacted]. The personnel implementing the *SAP* will be selected by the PM. Decisions regarding project scope, sampling locations and collection equipment, or other project-related issues, will be made by the PM.

The Quality Assurance Officer (QAO) for the project will be [redacted]. The level of Quality Assurance (QA), QA procedures, and overall *QAPP* development is the responsibility of the QAO. All decisions regarding the *QAPP* and related issues should be made by the QAO.

The Field Operations Manager (FOM) for the project will also be [redacted]. Implementation of the *SAP* and the *QAPP* at the Site is the responsibility of the FOM. Field-level decisions not affecting project quality will be made by the FOM. Real-time assessment of the *QAPP* and recommendations for revisions will be made by the FOM to the QAO.

The Health and Safety Officer (HSO) for the project will be [redacted]. Preparation of the *Health and Safety Plan* (*HASP*), selection of personnel protective equipment (PPE), Health and Safety (H&S) record keeping, and evaluation of *HASP* effectiveness are the responsibility of the HSO.

3.2 Data Quality Objectives (DQOs)

Data collected during the field sampling activities will be screened and compared to the following recognized environmental standards, criteria, or screening levels:

- **Soil –** current USEPA Regional Screening Levels for Contaminants at Superfund Sites for industrial soil.
- **Groundwater –** current USEPA Regional Screening Levels for Contaminants at Superfund Sites for tap water.

In the absence of a federal standard, the following state action levels will be used:

- **Soil –** current *West Virginia Voluntary Remediation and Redevelopment Act Guidance Manual* de minimis standards for residential and/or industrial soil and migration to groundwater.

- **Groundwater -** current *West Virginia Voluntary Remediation and Redevelopment Act Guidance Manual* de minimis standards for groundwater or the current West Virginia code of state regulation *46CSR12 Requirements Governing Groundwater Standards*, whichever is most stringent.

These data will be used to prepare a HRS site score using the USEPA QuickScore version 3.0 computer model and may be used to prepare a preliminary risk assessment, based on USEPA Risk Assessment Guidance for superfund (RAGS) and the West Virginia Voluntary Remediation and Redevelopment Act (VRRDA). Finally, these data may also be used by USEPA and/or WVDEP for regulatory decision making that could include pursuing further action under CERCLA, Order of Consent negotiations, listing of the Site on the National Priority List (NPL) under CERCLA, or action under a State-lead program such as the West Virginia VRRDA.

3.3 Special Training Requirements and Certification

All on-site personnel will possess current 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operation and Emergency Response (HAZWOPER) training, and eight-hour OSHA HAZWOPER annual refresher training. Finally, all on-site personnel will participate in the TRIAD medical monitoring program.

3.4 Data Validation Process

In accordance with the approved Work Plan and as authorized by the USEPA Region III, Site Assessment Manager, field samples obtained from the Site will be managed and analyzed according to the specifications of the current Statement of Work (SOW). Triad will coordinate these activities with the WVDEP, OER and the USEPA Region III, CLP Project Officer (PO).

As summarized in the document, *Understanding Region III Data Validation* (February 25, 2000), USEPA Region III data validation procedures consist of five levels of data validation:

- Three organic review procedures (M-1, M-2, and M-3)
- Two inorganic review procedures (IM-1 and IM-2)

Based on the DQOs for this project, organic data will be validated following M-2 procedures and inorganic data will be validated following IM-1 procedures as outlined in the *Understanding Region III Data Validation.*

3.5 CLP Paperwork Requirements

Paperwork requirements for the CLP review procedures are summarized in the Users' Guide for Acquiring Analytical Services, Revision 5 (ASQAB, August 2005). In accordance with USEPA and OER recommendations, Triad will also use the USEPA FORMS II Lite computer program to prepare, track, and manage field sampling documentation.

3.5.1 Analytical Request

Triad will schedule the CLP samples no later than four weeks before the start of the proposed sampling through the USEPA Region III Client Services Team Regional Sample Control Center (RSCC), which coordinates with the contractor-operated Contract Laboratory Analytical Support Services (CLASS). The CLASS contractor receives the regional analytical requests, coordinates and schedules sample analyses, and tracks sample shipments.

When submitting the analytical request, the tables with the analyte, CAS number, action limit, and project required quantitation limit (*SAP* tables 2-3) will be attached to the request form for each method and matrix being requested. This SAP will also be submitted with the analytical request. Information about submitting analytical requests to the USEPA Region III Client Services Team and the analytical request form to be used can be found at http://www.epa.gov/region03/esc/index.htm.

3.5.2 Case Number/Sample Delivery Group

The USEPA CLASS contractor will assign a case number in the format of five digits (XXXXX) one business day before the start of the proposed CLP sampling event. This provides both confidentiality for the Site and enables the CLASS contractor and Region III to track the sampling event. The laboratory will assign a sample delivery group (SDG). A SDG is also used to identify groups of samples within a sampling event. The SDG is defined as the following (whichever come first):

- All samples within a case
- Every set of 20 samples within a case
- Field samples within a case which are received at a laboratory during a specified period of time (usually within 14 days).

3.5.3 Sample Numbering

Triad will use the FORMS II Lite computer program to assign unique sample numbers. Unique sample numbers will be assigned to each organic and inorganic sample. All unused sample labels will be destroyed to prevent potential accidental duplication of any sample numbers.

3.5.3.1 Organic Sample Numbers

Organic sample numbers are in the format XXXXX (five characters). The first letter represents the Region (typically "C"), the remaining letters and numbers are used for sequential sample numbering.

3.5.3.2 Inorganic Sample Numbers

Inorganic sample numbers are in the form MXXXXX (six characters). The "M" indicates that this sample is inorganic, the second letter indicates the Region, and the remaining letters and number are used for sequential sample numbering.

3.5.4 Sample Labeling and Tags

After samples have been collected, they will be placed into certified pre-cleaned, containers. Each container will have a CLP sample label and tag generated using the FORMS II Lite computer program. The sample tag will be provided by USEPA Region III; although, the sample label placed on the tag will be generated by Triad using the FORMS II Lite computer program. Each sample container label will have the following information:

- Sample number
- Analysis required

Each sample container tag will have the following information:

- CLP case number
- Tag number
- Sample number
- Station location
- Date and time of sample collection
- Type of sample (composite or grab)
- Initials of sampler
- Signature of sampler
- Analysis information

3.5.5 Sample Packaging and Shipping

After a sample label and tag have been placed on each sample container, the outside of each container will then be wiped clean. A strip of clear tape will be applied on the label to ensure the ink does not smear. Clear tape will also be placed on the label on the tag. Each sample will then be packaged and shipped in the following manner:

- Check lid/cap to ensure proper closure to eliminate leaks
- Check to ensure label is intact and covered with clear tape
- Check to ensure tag is intact and covered with clear tape
- Place the labeled sample container and tag in a clear plastic bag and zip bag
- Ensure that samples which need to be kept cool (4 ± 2^{o}C) are cooled before being enclosed in bubble wrap and placed in the shipping container
- Place the sample in a clean waterproof metal or plastic cooler which has been lined with plastic
- Place double bagged ice on top of the samples
- Pack the shipping container with noncombustible absorbent packing material such as bubble wrap
- Securely close the top of the plastic lining of the shipping chest with plastic tape
- Enclose two copies of the CLP Traffic Report (TR)/chain-of-custody (CoC) in a clear plastic bag and tape to the underside of the shipping container lid
- Document instructions for returning the shipping container inside the cooler lid

- Tape the cooler shut using strapping tape over the hinges
- Place custody seals across the top and sides of the cooler so that they will be broken at the signature section of the seal when the shipping chest is opened
- Place clear tape over the custody seals to prevent accidental damage during shipment
- Place return address label clearly on the outside of the shipping container
- If more than one shipping container is being sent to a laboratory, mark the sequence of shipping containers, 1 of 2, etc.
- Ship by overnight delivery through a commercial carrier, in accordance with Department of Transportation (DOT) and International Air Transport Association (IATA) regulations
- Fill out an air bill for each laboratory and address the recipient as "sample custodian"

3.5.6 Custody Seals

Each sample shipping chest will be sealed with strapping tape and with at least two CLP custody seals. CLP custody seals will be provided by USEPA Region III. The custody seals will be placed so that they will be broken at the signature section when the shipping chest is opened. Each custody seal shall include the following information:

- Date of sample collection
- Signature of sampler

3.5.7 Traffic Report/Chain of Custody

Organic and inorganic CLP traffic report/chain-of-custody (TR/CoC) forms will be generated using the FORMS II Lite computer program at the end of the work shift for the sample procured during that shift. Both copies of the TR/CoC from sent to the laboratory shall include the following information:

- Release Signature of FOM or authorized representative
- Initials of sampler(s)
- Date and time relinquished
- Case number
- Sample numbers
- Sample matrix

- Type of sample (grab or composite)
- Analyses requested/turnaround time
- Tag number/preservative information
- Station location
- Date and time of sample collection
- Designation of laboratory QC samples
- Date shipped/method of shipment/air bill number/laboratory address

Each CLP chain-of-custody form will be distributed as follows:

- One copy to the RSCC
- One copy to the CLASS
- Two laboratory copies will be placed into a zip-lock type bag, which will then be placed into the shipping chest to accompany the sample containers to the CLP laboratory

A copy of the Region TR/CoC from will be sent within five business days of sampling to

RSCC Coordinator
USEPA Region III OASQA
Maples Road
Fort Meade, MD 20755-5350

3.5.8 Communicated Shipping Information

Triad will communicate the following information to the RSCC or CLASS Coordinator for all shipping chest shipment:

- Name, phone number, and region
- Case number
- Number and matrices (water, soils, etc.) of samples shipped
- Type of analysis required
- Laboratory name
- Overnight carrier (FedEx) and air bill numbers
- Shipment date

- Information on completions, changes, delays, continuations, etc.
- Suspected contaminants associated with the samples or site if applicable

3.5.9 Field Log Book

The FOM will be responsible for maintaining a log book(s) that document field activities. Criteria for the log book include:

- Bounded notebook
- Indelible ink used for entries
- Entries should be factual, detailed, and objective
- Date and time of all entries
- Each individual page signed by the person recording the information

The FOM will document on a daily basis in the log book on-site personnel, visitors, and activities. Information to be recorded will include, at a minimum:

- Date and time of entry
- Purpose of sampling
- Name, address, and affiliation of personnel performing sampling
- Name and address of the responsible party, if known
- Type of sample, e.g. surface soil, groundwater, etc.
- Description of sample containers
- Description of samples
- Chemical components and concentration, if known
- Number and size of samples taken, including the corresponding sample tag numbers for each analytical fraction
- Description and location of the sampling point
- Date and time of sample collection
- Difficulties experienced in obtaining sample if applicable
- Visual references, such as maps or photographs of the sampling site. Include the film roll number, the frame number, and a written description of the picture for photographs.
- Field observation, such as weather conditions during sampling periods

- Field measurements of the materials, e.g.: specific conductivity, pH, temperature
- Whether chain-of-custody forms have been filled out for the samples; chain-of-custody form numbers
- Global Positioning System (GPS) related information (latitude and longitude) for the Site and each sampling location
- Laboratory name, address, and date shipped

3.5.10 CLP Paperwork Corrections

If an error occurs regarding paperwork, the PO will inform Triad when an error or discrepancy has occurred. The following procedures will be followed for correcting errors and omissions on original legal documents are as follows:

- Errors and discrepancies discovered before shipment of samples from the Site will be corrected by the FOM by drawing a single line in indelible ink through the error and entering the correct information. The FOM will initial and date each correction.
- All paperwork errors and discrepancies discovered post-shipment will be corrected by a memo-to-file.

3.5.11 Memo-to-File

The USEPA considers a memo-to-file to be a business letter on company letterhead, and not a memorandum, which becomes part of the evidentiary file for the project. The memo-to-file must include a synopsis of the error and an explanation of the information that should have been sent or the action that should have occurred. The memo-to-file will be signed by either the FOM or PM. The memo-to-file, at a minimum, must include the following information:

- Carrier used
- Air bill number
- Shipment date
- Sample number(s)
- Sample station location
- Time and date of sampling
- Sample tag number(s)
- Document number located at the bottom right-hand corner of the chain-of-custody form.

In addition to preparing one copy of the original memo-to-file for our project files, TRIAD will distribute memos-to-file as applicable to the following:

- Laboratory
- RSCC
- CLASS
- USEPA Project Manager for the Site

3.6 Analytical Procedures

The samples will be subject to analyses for the analytical parameters identified in the *SAP*. The samples will be analyzed according to the specifications of the current Superfund CLP SOW for organic and inorganic compounds respectively, and according to SW-846 as appropriate (VOC collection).

3.7 Quality Control Requirements

3.7.1 Documentation and Records

As discussed in Section 3.5.9 of this *QAPP*, the FOM will maintain a daily log book that records all on-site personnel, visitors, and activities. The information to be recorded is summarized in Section 3.5.9. In addition to this information, Triad will prepare geologic logs for any direct push borings or morning well installations, which will include where applicable; depths of samples, sample numbers, material descriptions, notations of groundwater encountered, notations of any waste material (or evidence thereof) encountered, and any field instrument readings as appropriate.

3.7.2 Quality Control Samples

Triad will obtain field and matrix QC samples during the work to assess sampling precision and matrix effects. The following QC samples will be obtained:

- Field duplicate
- Field blank
- Volatile trip blank
- Equipment or rinse blank

- Temperature blanks
- Matrix spike/matrix spike duplicate (MS/MSD)
- Matrix spike and matrix duplicate (MS/DUP)

3.7.3 Instrument Calibration and Verification

As appropriate, calibration, certification and maintenance schedules and records will be maintained for the equipment according to the manufacturers specifications. Equipment that is identified as out-of-calibration or malfunctioning will be removed from operation until recalibrated or repaired. The calibration/verification recorded will include the following information:

- the name of the person calibrating or verifying calibration of the instrument
- serial number of the instrument
- the date and time of calibration or verification performed

3.7.4 Decontamination and Personal Protective Equipment

PPE and field sampling equipment shall be decontaminated at the Site to prevent or reduce the potential for cross-contamination. PPE shall be decontaminated using the methods detailed in the approved *HASP*. In general, the following guidelines will be followed unless modified in the approved *HASP*.

1) PPE in direct contact with the sample material (e.g., outer gloves) will be decontaminated or replaced between samples. Outer gloves will be replaced at each new boring location.
2) Contaminated PPE will be placed into drums or other suitable containers located at the Site, and disposed of as IDW. IDW management will follow instructions in the approved *SAP*.

Field sampling equipment shall be decontaminated between samples as per the following nine-step procedure:

1) Initially remove physical contamination by any or all of the following abrasive cleaning methods: washing, brushing, and air/water blasting.
2) Wash equipment with a non-phosphate detergent

3) Rinse with tap water.
4) Rinse with distilled/deionized water.
5) Rinse with 10% nitric acid if the sample will be analyzed for trace inorganics.
6) Rinse with distilled/deionized water.
7) Use a solvent rinse (pesticide grade hexane) if the sample will be analyzed for organics.
8) Air dry the equipment completely.
9) Rinse again with distilled/deionized water.

Selection of the solvent for used in the decontamination process is based on the contamination present at the Site. Use of a solvent is required when organic contamination is present on-site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. An acid rinse step is required if metals are present on-site. If a particular contaminant fraction is not present at the Site, the nine-step decontamination procedure listed above may be modified for site specificity. The decontamination solvent used should not be among the COCs at the Site. After each solvent rinse, the field sampling equipment should be air dried and rinsed with distilled/deionized water. Suitable solvent rinses are as follows:

SOLVENT	SOLUBLE CONTAMINANTS
1) Water	- Petroleum hydrocarbons - Inorganic compounds - Salts - Some organic acids and other polar compounds
2) Dilute Acids	- Metals - Basic (caustic) compounds - Amines - Hydrazines
3) Dilute Bases (e.g., soap and detergent)	- Acidic compounds - Phenol - Thiols - Some nitro and sulfonic compounds

4)	Organic solvents (e.g., alcohols, ethers, ketones, aromatics, straight-chain alkanes e.g., hexane)	- Nonpolar compounds (e.g., some organic compounds)

3.8 Assessment and Oversight

3.8.1 Performance and System Audits

3.8.1.1 Technical Performance Audits

The PM or assigned qualified Triad personnel will perform technical performance monitoring on an ongoing bases during the project, as field data are generated, reduced and analyzed. These monitoring activities will serve as a performance audit and will essentially be ongoing due to the length of the project schedule. All numerical analyses such as manual calculations, mapping, and computer modeling, will be documented and will be the subject of performance audits in the form of quality control review, numerical analysis, and peer review.

3.8.1.2 Field Performance Audits

Triad will perform at least one internal field performance audit during the sampling efforts of the SIR to monitor compliance with the *SAP*. Field sampling and associated activities will be audited at least once annually. The purpose of field performance audits is to ensure that the methods and protocols detailed in the *QAPP* are being consistently adhered to in the field.

These activities will be reviewed for their adherence to the procedures established in the *SAP* and this *QAPP*. As part of the field audit, the field log book maintained by the FOM will be reviewed to verify that field-related activities were performed in accordance with appropriate project procedures. Items reviewed will include, but are not limited to, field equipment calibration records, daily field log book, and adherence to CLP field and data validation QC procedures.

3.8.1.3 Project System Audits

Triad may periodically perform a project system audit. The PM must respond by submitting the project *QAPP*, and auditor will then determine whether the *QAPP* is in place. The auditor will also determine whether the audits and monitoring called for in the ASPP have been, or are being, conducted. Certain projects may be identified for a more formal audit on a scheduled basis. Those audits evaluate, in-depth, the implementation of the *QAPP* in the project as it applies to field and laboratory data analysis and reduction procedures.

3.8.2 Corrective Action

3.8.2.1 Field Corrective Action

The initial responsibility for monitoring the quality of field measurements and observation lies with the field personnel. The PM is responsible for verifying that all QC procedures are being followed. This requires the PM to assess the correctness of field methods and their ability to meet the QA objectives. If a problem occurs that might jeopardize the integrity of the project or cause failure to meet some specific QA objective, it is the responsibility of all field project personnel to report it. Field project personnel must report all such suspected problems to the FOM. The FOM must report all such suspect problems to the PM. The PM will document the problem, develop the corrective action, and document the results. The PM will initiate the corrective action and identify and direct the appropriate personnel to implement the corrective action.

3.8.3 Reports to Management

Quality assurance reports to management will consist of prior notification of activities and reports on activities. Reports will encompass both routine reports and special reports, including written reports and memoranda documenting data assessment activities, results of data validations, audits, non-conformance, corrective actions, and quality notices. The management hierarchy receiving some of all of the reports will include appropriate personnel from Triad.

Notification of all quality assurance activities will be provided in the final report and describe the progress, the completion, and sometimes the results of quality assurance activities. Description of the completion of activities will serve as notice to all managers of the availability of quality assurance reports.

3.9 Data Validation and Usability

The following sections describe the processes of generating and checking data and producing reports for both field sampling and laboratory analytical data. As discussed previously in the *SAP*, laboratory analytical data will be validated for this project under the USEPA Region III CLP.

3.9.1 Data Reduction

Data will be reduced either manually on calculation sheets or by computer on formatted printouts. The following responsibilities will be delegated in the data reduction process:

- Technical personnel will document and review their own work and are accountable for its correctness.
- Major calculations will receive both a method and an arithmetic check by an independent checker. The checker will be accountable for the correctness of the checking process.
- The PM will be responsible for ensuring that data reduction is performed in a manner that produces quality data through review and approval of calculation.

Hand calculations will be legibly recorded on calculation sheets and in logical progression with sufficient descriptions. Major calculations will be checked by an engineer or scientist of professional level equal to or higher than that of the originator. After completing the check, the checker will initial and date the calculation sheet immediately below the originator. Both the originator and checker are responsible for the correctness of calculations. A calculation sheet will contain the following, at a minimum:

- Project title and brief description of the task
- Date performed
- Initials of person performing the calculation
- Basis for calculation
- Assumptions made or inherent in the calculation
- Complete reference for each source of input data
- Methods used for calculations
- Results of calculations, clearly annotated

Computer analyses include the use of models, programs, and data management systems. For published software with existing documentation, test case runs will be performed periodically to verify that the software is performing correctly. Both systematic and random-error analysis will be investigated and appropriate corrective action measures taken.

3.9.2 Data Validation and Verification

The process through which data will be accepted or rejected will be based on specific data verification and validation criteria. These criteria are discussed below for both field and laboratory data. Personnel experienced with sampling and analytical protocols and procedures will perform the data validation in accordance with the established criteria and the intended use of the data.

Field data verification and validation will be used to eliminate or limit the use of field data that are not collected or documented in accordance with specified protocols outlined here or in the approved *SAP*. In some instances, the field data will be used only for approximation purposes. In all cases, evaluation of field data will be performed on two separate levels. First, all field data will be verified at the time of collection by following the QC checks outlined throughout the approved *SAP*. Second, field data will be validated by the PM or FOM, who will review the field data documentation to identify discrepancies or unclear entries. Field data documentation will be validated against the following criteria, as appropriate:

- Sample locations and adherence to the *SAP*
- Adherence to USEPA Region III CLP procedures and protocols
- Field instrumentation and calibration
- Sample volume
- Equipment QC samples collected and submitted
- Field duplicate samples collected and submitted
- Sample labels and tags protocols
- Sample documentation protocols
- Chain-of-custody protocols
- Sample shipment

3.9.3 Data Quality Assessment

Data quality assessments will be prepared to document the overall quality of data collected in terms of the established DQOs and the effectiveness of the data collection and generation processes. The data assessment parameters calculated from the results of the field measurements and laboratory analyses will be reviewed to ensure that all data used in subsequent evaluations are scientifically valid, of known and documented quality, and where appropriate, legally defensible. In addition, the performance of the overall measurement system will be evaluated in terms of the completeness of the project plans, effectiveness of the field measurement and data collection procedures, and relevance of laboratory analytical methods used to generate data as planned. Finally, the goal of the data quality assessment is to present the findings in terms of data usability.

Generally, to achieve an acceptable level of confidence in the decisions that will be made from analysis of the data, the degree to which the total error in the results derived from data collected and generated must be controlled. The methods and procedures used to implement and accomplish these QC objectives are as follows:

- Assess the quality of data values measured and generated to ensure that all are scientifically valid, of known and documented quality, and, where appropriate, legally defensible. This will be accomplished by assessing actual data values generated or measured against the established DQOs for parameters such as precision, accuracy, completeness, representativeness, and comparability, and by testing generated data against acceptance criteria established for these parameters.
- Achieve an acceptable level of confidence in the decisions that are to be made from measurements and data by controlling the degree of total error permitted in the data through QC checks. Data that fail the QC checks or do not fall within the acceptance criteria established will be rejected from further use or qualified for limited use.

The major components of the data quality assessment are presented below and show the logical progression of the assessment leading to determination of data usability:

- **Data Validation Summary**. Summarizes the individual data validation reports for all sample delivery groups by analytical method. Systematic problems, data generation trend, general conditions of the data, and reasons for data qualification are presented.

- **Data Evaluation Procedures**. Describes the procedures used to further qualify data caused by such factors as dilution, reanalysis, matrix effect and duplicate analysis of samples. Examples of the decision logic are provided to illustrate the methods by which qualifiers are applied.
- **QC Sample Evaluation.** Evaluates QC samples such as field blanks, trip blanks, equipment rinsates, field duplicates, and laboratory control samples to assess the quality of the field activities and laboratory and field control samples in relation to objectives established.
- **Assessment of Data Quality Objectives.** Assesses the quality of data measured and generated in terms of accuracy, precision, representativeness, and completeness through the examination of laboratory and field control samples in relation to objective established.
- **Summary of Data Usability**. Summarizes the usability of data, based on the assessment of data conducted during the previous four steps. Sample results for each analytical method will be qualified as acceptable, rejected, estimated, biased high, or biased low.

3.9.4 Data Reporting

Field measurements and observation will be recorded in the field log book maintained by the FOM. Laboratory data will be reported in standard formats that identify the specific sample, date, parameter, parameter value, detection limit, and various analytical parameters. Both field and laboratory data will be combined and summarized as appropriate to the type of data and convey information to support the findings of the data

collection program. In all cases, data will be clearly tabulated and presented in a consistent manner to support comparison of a common set of data. Finally, data will be presented to logically lead to and substantiate the conclusions and recommendations provided by the final report, to be prepared under the approved work plan.

3.10 Reconciliation with Data Quality Objectives

All data generated from the project will be assessed for accuracy, precision, completeness, representativeness, and comparability. The methods for calculating accuracy, precision, and completeness and for evaluating representativeness and comparability are summarized in USEPA guidance documents (USEPA 1990a). Generally, data that do not meet the established acceptance criteria may be cause for re-sampling and re-analysis. However, in some cases data that do not meet acceptance criteria are usable with specified limitations. Data that are marked as usable with limitations will be included in the project reports, but will be clearly marked as having limited usability. This is particularly necessary when overall completeness is not achieved and especially for critical samples.

3.10.1 Precision

Precision examines the spread of data about their mean. The spread presents how different the individual reported values are from the average reported values. Precision is thus a measure of the magnitude of errors and will be expressed as the relative percent difference (RPD) or the relative standard deviation (RSD). The lower these values are, the more precise that data. These quantities were defined as follows:

$$\mathbf{RPD\ (\%) = 100 \times \frac{(S - D)}{(S + D)/2}}$$

OR

$$\mathbf{RPD\ (\%) = \frac{100}{2} \times \frac{2\ (S - D)}{(S + D)}}$$

where S = Analyte or compound concentration in a sample
D = Analyte or compound concentration in a duplicate sample

Or when there are more than two measurements:

$$\mathbf{RSD\ (\%) = 100\ \frac{(s)}{X}}$$

Where *s* = Standard deviation of replicate measurements
x = Mean of replicate measurements

3.10.2 Accuracy

Accuracy measures the average or systematic error of an analytical method. This measure is defined as the difference between the average of reported values and the actual value. Accuracy will be expressed as the percent bias for standard reference samples. The closer this value is to zero, the more accurate the data. This quantity is defined as follows:

$$\textbf{Bias (\%)} = \frac{\textbf{(MC – KC)}}{\textbf{KC}} \times 100$$

Where KC = Known analyte or compound (i.e. spike) concentration
MC = Measured analyte or compound concentration

In cases where accuracy is determined from spiked samples, accuracy will be expressed as the percent recovery. The closer these values are to 100, the more accurate the data. Surrogate recovery will be calculated as follows:

$$\textbf{Recovery (\%)} = \frac{\textbf{(MC)}}{\textbf{SC}} \times 100$$

Where SC = Known analyte or compound (i.e. spike) concentration
MC = Measured analyte or compound concentration

Matrix spike percent recovery will be calculated as follows:

$$\textbf{Recovery (\%)} = \frac{\textbf{(MC – USC)}}{\textbf{KC}} \times 100$$

Where SC = Known analyte or compound (i.e. spike) concentration
MC = Measured analyte or compound concentration
USC = Unspiked sample concentration

In instances where data can be adjusted to correct for systematic errors before data evaluation, the correction factor and rationale for correction will be fully documented and presented in the report that summarizes the data.

3.10.3 Completeness

Completeness establishes whether a sufficient number of valid measurements were obtained. The closer this value is to 100, the more complete the measurement process. This quantity will be calculated as follows:

$$\textbf{Completeness (\%)} = \frac{\mathbf{V}}{\mathbf{P}} \times \mathbf{100}$$

Where V = Number of valid measurements

P = Number of planned measurements

3.10.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent the environmental condition. Following a determination of precision, a statement on representativeness will be prepared noting the degree to which data represent the environmental and contaminant conditions under investigation.

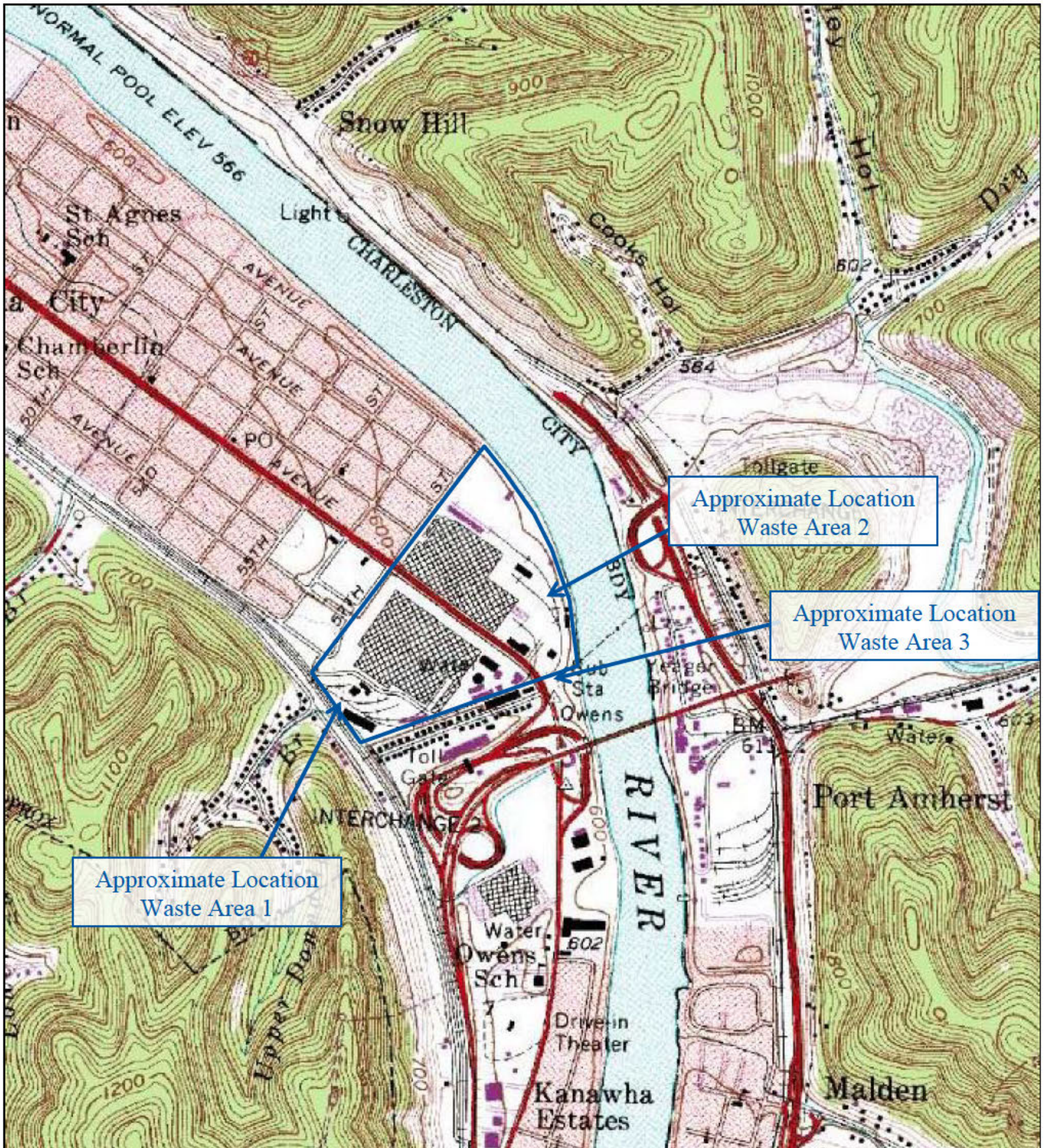
3.10.5 Comparability

Comparability expresses the confidence with which one set of data can be compared to another. Following the determination of precision and accuracy, a statement on comparability will be prepared citing the acceptance criteria established in relation to use of the data sets in further evaluations and modeling of the environmental and contaminant conditions under investigation. A statement on comparability will also be prepared when the data collected are used with data reported from another or previous study.

FIGURE 1

SITE LOCATION MAP

TRIAD ENGINEERING, INC.



SOURCE: *Charleston East, W.Va* USGS	**LIBBY OWENS FORD PLANT** **CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA** **Site Location Map**	TRIAD ENGINEERING, INC.
DATE: 1976	**TRIAD PROJECT NO: 04-10-0052**	**FIGURE NO: 1**

FIGURE 2

AERIAL PHOTOGRAPH, Google 2009

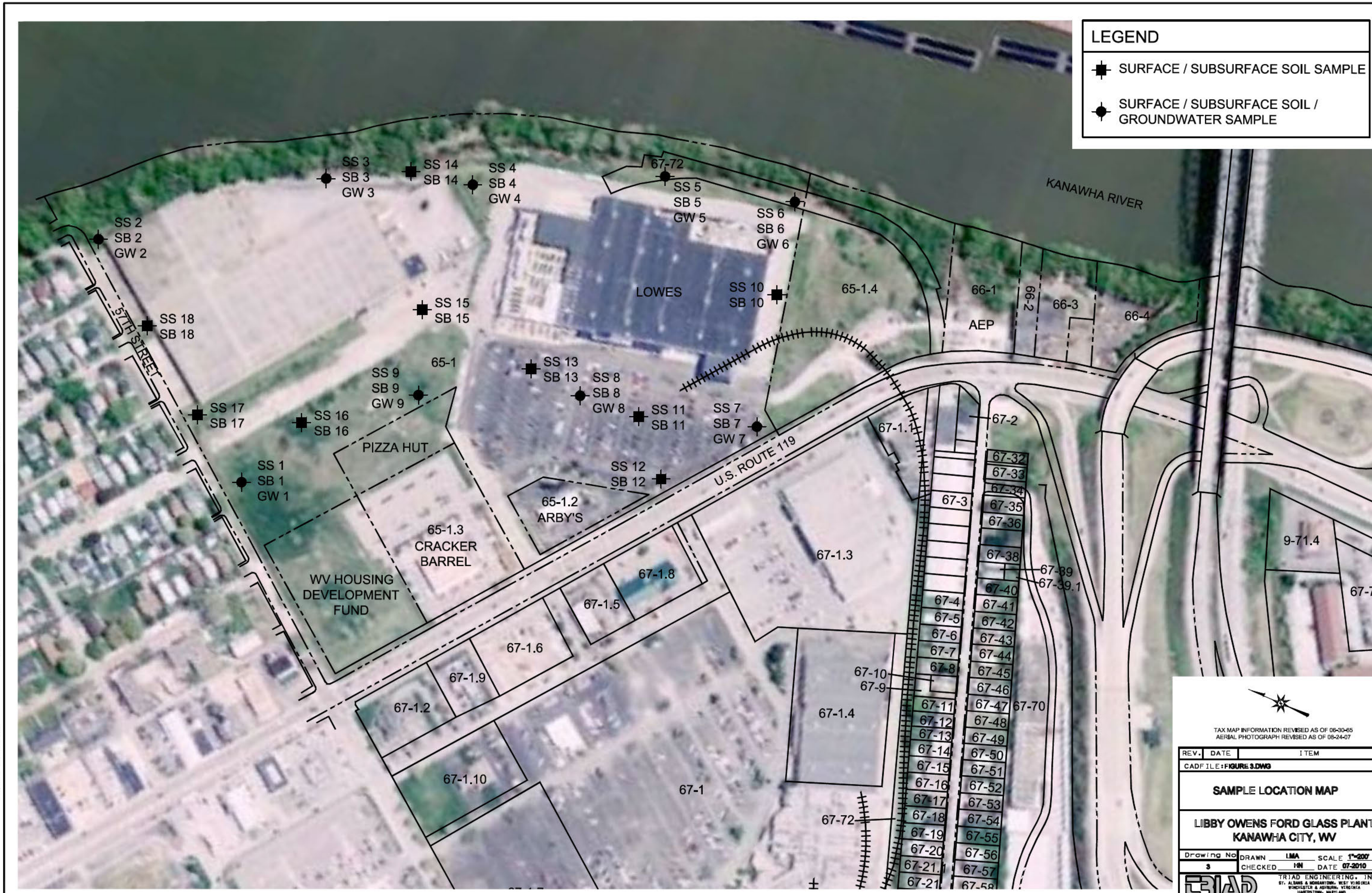
TRIAD ENGINEERING, INC.

SOURCE: Google	LIBBY OWENS FORD PLANT CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA **Aerial Photograph**	TRIAD ENGINEERING, INC.
DATE: 2009	**TRIAD PROJECT NO: 04-10-0052**	**FIGURE NO: 2**

FIGURE 3

SAMPLE LOCATION MAP

TRIAD ENGINEERING, INC.



PROJECT NO.: 04-10-0052

PLOTSCALE: 1=1

CADFILE: FIGURES.DWG

TABLES

TRIAD ENGINEERING, INC.

Table 1. SAMPLING AND ANALYSIS SUMMARY
Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Environmental Media	TCL Organics		TAL Inorganics	Sample Summary	
	VOC	BNA	Metals	Number	Type
Surface soil					
surface soil background	0	1	1	1	Grab
on-site surface soil	0	18	18	18	Grab
Subsurface Soil					
subsurface soil background	1	1	1	1	Grab
on-Site subsurface soil	18	18	18	18	Grab
Groundwater					
on-Site groundwater via direct push	9	9	9*	9	Grab
Total	**28**	**47**	**47**	**47**	

Notes:

"TCL" USEPA Target Compound List under Contract Laboratory Program

"TAL" USEPA Target Analyte List under Contract Laboratory Program

* Indicates sample will be analyzed for Total and Dissolved Metals

Table 1. SAMPLING AND ANALYSIS SUMMARY (continued)
Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Environmental Media	Number of Samples Collected and CLP Analyses		
	TCL Organics		TAL Inorganics
	VOC	BNA	Metals
Soil/Sediment			
surface soil	0	19	19
subsurface soil	19	19	19
Subtotal	**19**	**38**	**38**
Aqueous			
groundwater	9	9	9*
Subtotal	**9**	**9**	**9**
Total	**28**	**47**	**47**

Notes:

"TCL" USEPA Target Compound List under Contract Laboratory Program

"TAL" USEPA Target Analyte List under Contract Laboratory Program

* Indicates sample will be analyzed for Total and Dissolved Metals

Table 2. SOIL LABORATORY ANALYSIS SUMMARY
Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Target Analyte	CAS Number	Screening Criteria Industrial	Project Quantitation Limit
Volatile Organic Compounds (VOC) (ug/Kg) SOM01.2-Low Soil			
Dichlorodifluoromethane	75718	780,000	5.0
Chloromethane	74873	500,000	5.0
Vinyl Chloride	75014	1,700	5.0
Bromomethane	74839	32,000	5.0
Chloroethane (ethyl chloride)	75003	61,000,000	5.0
Trichlorofluoromethane	75694	3,400,000	5.0
1,1-Dichloroethene	75354	1,100,000	5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	180,000,000	5.0
Acetone	67641	630,000,000	10
Carbon Disulfide	75150	3,700,000	5.0
Methyl Acetate	79209	1,000,000,000	5.0
Methylene Chloride	75092	53,000	5.0
trans-1,2-Dichloroethene	156605	690,000	5.0
Methyl tert-butyl ether	1634044	220,000	5.0
1,1-Dichloroethane	75343	17,000	5.0
cis-1,2-Dichloroethene	156592	10,000,000	5.0
2-Butanone (methyl ethyl ketone)	78933	200,000,000	10
Bromochloromethane	74975	NV	5.0
Chloroform	67663	1,500	5.0
1,1,1-Trichloroethane	71556	38,000,000	5.0
Cyclohexane	110827	29,000,000	5.0
Carbon Tetrachloride	56235	3,000	5.0
Benzene	71432	5,400	5.0
1,2-Dichloroethane	107062	2,200	5.0
1,4-Dioxane	123911	160,000	100
Trichloroethene	79016	14,000	5.0
Methylcyclohexane	108872	NV	5.0
1,2-Dichloropropane	78875	4,500	5.0
Bromodichloromethane	75274	1,400	5.0
cis-1,3-Dichloropropene	26952238	NV	5.0
4-Methyl-2-pentanone (methyl isobutyl ketone)	108101	53,000,000	10
Toluene	108883	45,000,000	5.0
trans-1,3-Dichloropropene	10061026	NV	5.0
1,1,2-Trichloroethane	79005	5,300	5.0
Tetrachloroethene	127184	2,600	5.0
2-Hexanone	591786	1,400,000	10
Dibromochloromethane	124481	3,300	5.0
1,2-Dibromoethane	106934	170	5.0
Chlorobenzene	108907	1,400,000	5.0
Ethylbenzene	100414	27,000	5.0
Xylenes (total)	1330207	2,700,000	5.0
Styrene	100425	36,000,000	5.0
Bromoform	75252	220,000	5.0
Isopropylbenzene (cumene)	98828	11,000,000	5.0
1,1,2,2-Tetrachloroethane	79345	2,800	5.0

Table 2. SOIL LABORATORY ANALYSIS SUMMARY

Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Target Analyte	CAS Number	Screening Criteria Industrial	Project Quantitation Limit
1,3-Dichlorobenzene	541731	NV	5.0
1,4-Dichlorobenzene	106467	12,000	5.0
1,2-Dichlorobenzene	95501	9,800,000	5.0
1,2-Dibromo-3-chloropropane	96128	69	5.0
1,2,4-Trichlorobenzene	120821	99,000	5.0
1,2,3-Trichlorobenzene	87616	490,000	5.0
Base, Neutral, and Acid (BNA) (ug/Kg) SOM01.2-Low Soil			
Benzaldehyde	100527	100,000,000	170
Phenol	108952	180,000,000	170
bis-(2-Chloroethyl) ether	111444	1,000	170
2-Chlorophenol	95578	5,100,000	170
2-Methylphenol (o-cresol)	95487	31,000,000	170
2,2'-oxybis(1-Chloropropane)	108601	22,000	170
Acetophenone	98862	100,000,000	170
4-Methylphenol (p-cresol)	106445	3,100,000	170
N-Nitroso-di-n-propylamine	621647	250	170
Hexachloroethane	67721	120,000	170
Nitrobenzene	98953	24,000	170
Isophorone	78591	1,800,000	170
2-Nitrophenol	88755	NV	170
2,4-Dimethylphenol	105679	12,000,000	170
bis(2-Chloroethoxy)methane	111911	1,800,000	170
2,4-Dichlorophenol	120832	1,800,000	170
Naphthalene	91203	18,000	170
4-Chloroaniline	106478	8,600	170
Hexachlorobutadiene	87683	22,000	170
Caprolactam	105602	310,000,000	170
4-Chloro-3-methylphenol (p-chloro-m-cresol)	59507	62,000,000	170
2-Methylnaphthalene	91576	4,100,000	170
Hexachlorocyclopentadiene	77474	3,700,000	170
2,4,6-Trichlorophenol	88062	160,000	170
2,4,5-Trichlorophenol	95954	62,000,000	170
1,1'-Biphenyl	92524	51,000,000	170
2-Chloronaphthalene	91587	82,000,000	170
2-Nitroaniline	88744	6,000,000	330
Dimethylphthalate	131113	NV	170
2,6-Dinitrotoluene	606202	620,000	170
Acenaphthylene	208968	33,000,000	170
3-Nitroaniline	99092	NV	330
Acenaphthene	83329	33,000,000	170
2,4-Dinitrophenol	51285	1,200,000	330
4-Nitrophenol	100027	NV	330
Dibenzofuran	132649	1,000,000	170
2,4-Dinitrotoluene	121142	5,500	170
Diethylphthalate	84662	490,000,000	170
Fluorene	86737	22,000,000	170

Table 2. SOIL LABORATORY ANALYSIS SUMMARY

Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Target Analyte	CAS Number	Screening Criteria Industrial	Project Quantitation Limit
4-Chlorophenyl-phenyl ether	7005723	NV	170
4-Nitroaniline	100016	86,000	330
4,6-Dinitro-2-methylphenol (4,6-dinitro-o-cresol)	534521	49,000	330
N-Nitrosodiphenylamine	86306	350,000	170
1,2,4,5-Tetrachlorobenzene	95943	180,000	170
4-Bromophenyl-phenylether	101553	NV	170
Hexachlorobenzene	118741	1,100	170
Atrazine	1912249	7,500	170
Pentachlorophenol	87865	9,000	330
Phenanthrene	85018	170,000,000	170
Anthracene	120127	170,000,000	170
Carbazole	86748	NV	170
Di-n-butylphthalate	84742	62,000,000	170
Fluoranthene	206440	22,000,000	170
Pyrene	129000	17,000,000	170
Butylbenzylphthalate	85687	910,000	170
3,3'-Dichlorobenzidine	91941	3,800	170
Benzo(a)anthracene	56553	2,100	170
Chrysene	218019	210,000	170
bis(2-Ethylhexyl)phthalate	117817	120,000	170
Di-n-octylphthalate	117840	NV	170
Benzo(b)fluoranthene	205992	2,100	170
Benzo(k)fluoranthene	207089	21,000	170
Benzo(a)pyrene	50328	210	170
Indeno(1,2,3-cd)pyrene	193395	2,100	170
Dibenzo(a,h)anthracene	53703	210	170
Benzo(g,h,i)perylene	191242	17,000,000	170
2,3,4,6-Tetrachlorophenol	58902	18,000,000	170
Metals (mg/Kg) ILM05.4-ICP-AES Soil			
Aluminum	7429905	990,000	20
Antimony	7440360	410	6
Arsenic	7440382	1.6	1
Barium	7440393	190,000	20
Beryllium	7440417	2,000	0.5
Cadmium	7440439	800	0.5
Calcium	7440702	NV	500
Chromium	7440473	5.6	1
Cobalt	7440484	300	5
Copper	7440508	41,000	2.5
Iron	7439896	720,000	10
Lead	7439921	800	1
Magnesium	7439954	NV	500
Manganese	7439965	NV	1.5
Mercury	7439976	34	0.1
Nickel	7440020	20,000	4
Potassium	7440097	NV	500

Table 2. SOIL LABORATORY ANALYSIS SUMMARY
Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Target Analyte	CAS Number	Screening Criteria Industrial	Project Quantitation Limit
Selenium	7782492	5,100	3.5
Silver	7440224	5,100	1
Sodium	7440235	NV	500
Thallium	7440280	NV	2.5
Vanadium	7440622	5,200	5
Zinc	7440666	310,000	6
Cyanide	57125	20,000	2.5

Notes:

Soil samples will be compared to the Regional Screening Levels for Chemical Contaminants at Superfund Sites (May 2010) industrial soil values.

Acenapthylene criteria based on surrogate PAH Acenaphthene.

Benzo(g,h,i)perylene criteria based on surrogate PAH Pyrene.

Phenanthrene criteria based on surrogate PAH Anthracene.

NV - No Value Available for compound

TABLE 3. GROUNDWATER LABORATORY ANALYTICAL SUMMARY

Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Target Analyte	CAS Number	Screening Criteria	Project Quantitation Limit
Volatile Organic Compounds (VOC) (ug/L) SOM01.2-Trace Water			
Dichlorodifluoromethane	75718	390	0.50
Chloromethane	74873	190	0.50
Vinyl Chloride	75014	0.016	0.50
Bromomethane	74839	8.7	0.50
Chloroethane (ethyl chloride)	75003	21,000	0.50
Trichlorofluoromethane	75694	1,300	0.50
1,1-Dichloroethene	75354	340	0.50
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	59,000	0.50
Acetone	67641	22,000	5.0
Carbon Disulfide	75150	1,000	0.50
Methyl Acetate	79209	37,000	0.50
Methylene Chloride	75092	4.8	0.50
trans-1,2-Dichloroethene	156605	110	0.50
Methyl tert-butyl ether	1634044	12	0.50
1,1-Dichloroethane	75343	2.4	0.50
cis-1,2-Dichloroethene	156592	370	0.50
2-Butanone (methyl ethyl ketone)	78933	7,100	5.0
Bromochloromethane	74975	NV	0.50
Chloroform	67663	0.19	0.50
1,1,1-Trichloroethane	71556	9,100	0.50
Cyclohexane	110827	13,000	0.50
Carbon Tetrachloride	56235	0.44	0.50
Benzene	71432	0.41	0.50
1,2-Dichloroethane	107062	0.15	0.50
1,4-Dioxane	123911	6.1	20
Trichloroethene	79016	2.0	0.50
Methylcyclohexane	108872	NV	0.50
1,2-Dichloropropane	78875	0.39	0.50
Bromodichloromethane	75274	0.12	0.50
cis-1,3-Dichloropropene	26952238	NV	0.50
4-Methyl-2-pentanone (methyl isobutyl ketone)	108101	2,000	5.0
Toluene	108883	2,300	0.50
trans-1,3-Dichloropropene	10061026	NV	0.50
1,1,2-Trichloroethane	79005	0.24	0.50
Tetrachloroethene	127184	0.11	0.50
2-Hexanone	591786	47	5.0
Dibromochloromethane	124481	0.15	0.50
1,2-Dibromoethane	106934	0.0065	0.50
Chlorobenzene	108907	91	0.50
Ethylbenzene	100414	1.5	0.50
Xylenes (total)	1330207	200	0.50
Styrene	100425	1,600	0.50
Bromoform	75252	8.5	0.50
Isopropylbenzene (cumene)	98828	680	0.50
1,1,2,2-Tetrachloroethane	79345	0.067	0.50
1,3-Dichlorobenzene	541731	NV	0.50

TABLE 3. GROUNDWATER LABORATORY ANALYTICAL SUMMARY Libby Owens Ford Plant Charleston, Kanawha County, West Virginia CERCLIS WVD005008412			
Target Analyte	**CAS Number**	**Screening Criteria**	**Project Quantitation Limit**
1,4-Dichlorobenzene	106467	0.43	0.50
1,2-Dichlorobenzene	95501	370	0.50
1,2-Dibromo-3-chloropropane	96128	0.00032	0.50
1,2,4-Trichlorobenzene	120821	2.3	0.50
1,2,3-Trichlorobenzene	87616	29	0.50
Base, Neutral, and Acid (BNA) (ug/L) SOM01.2-Low Water			
Benzaldehyde	100527	3,700	5.0
Phenol	108952	11,000	5.0
bis-(2-Chloroethyl) ether	111444	0.012	5.0
2-Chlorophenol	95578	180	5.0
2-Methylphenol (cresol)	95487	1,800	5.0
2,2'-oxybis(1-Chloropropane)	108601	0.32	5.0
Acetophenone	98862	3,700	5.0
4-Methylphenol (p-cresol)	106445	180	5.0
N-Nitroso-di-n-propylamine	621647	0.0096	5.0
Hexachloroethane	67721	4.8	5.0
Nitrobenzene	98953	0.12	5.0
Isophorone	78591	71	5.0
2-Nitrophenol	88755	NV	5.0
2,4-Dimethylphenol	105679	730	5.0
bis(2-Chloroethoxy)methane	111911	110	5.0
2,4-Dichlorophenol	120832	110	5.0
Naphthalene	91203	0.14	5.0
4-Chloroaniline	106478	0.34	5.0
Hexachlorobutadiene	87683	0.86	5.0
Caprolactam	105602	18,000	5.0
4-Chloro-3-methylphenol (p-chloro-m-cresol)	59507	3,700	5.0
2-Methylnaphthalene	91576	150	5.0
Hexachlorocyclopentadiene	77474	220	5.0
2,4,6-Trichlorophenol	88062	6.1	5.0
2,4,5-Trichlorophenol	95954	3,700	5.0
1,1'-Biphenyl	92524	1,800	5.0
2-Chloronaphthalene	91587	2,900	5.0
2-Nitroaniline	88744	370	10
Dimethylphthalate	131113	NV	5.0
2,6-Dinitrotoluene	606202	37	5.0
Acenaphthylene	208968	2,200	5.0
3-Nitroaniline	99092	NV	10
Acenaphthene	83329	2,200	5.0
2,4-Dinitrophenol	51285	73	10
4-Nitrophenol	100027	NV	10
Dibenzofuran	132649	37	5.0
2,4-Dinitrotoluene	121142	0.22	5.0
Diethylphthalate	84662	29,000	5.0
Fluorene	86737	1,500	5.0
4-Chlorophenyl-phenyl ether	7005723	NV	5.0
4-Nitroaniline	100016	3.4	10

TABLE 3. GROUNDWATER LABORATORY ANALYTICAL SUMMARY

Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Target Analyte	CAS Number	Screening Criteria	Project Quantitation Limit
4,6-Dinitro-2-methylphenol (4,6-dinitro-o-cresol)	534521	2.9	10
N-Nitrosodiphenylamine	86306	14	5.0
1,2,4,5-Tetrachlorobenzene	95943	11	5.0
4-Bromophenyl-phenylether	101553	NV	5.0
Hexachlorobenzene	118741	0.042	5.0
Atrazine	1912249	0.29	5.0
Pentachlorophenol	87865	0.56	10
Phenanthrene	85018	11,000	5.0
Anthracene	120127	11,000	5.0
Carbazole	86748	NV	5.0
Di-n-butylphthalate	84742	3,700	5.0
Fluoranthene	206440	1,500	5.0
Pyrene	129000	1,100	5.0
Butylbenzylphthalate	85687	35	5.0
3,3'-Dichlorobenzidine	91941	0.15	5.0
Benzo(a)anthracene	56553	0.029	5.0
Chrysene	218019	2.9	5.0
bis(2-Ethylhexyl)phthalate	117817	4.8	5.0
Di-n-octylphthalate	117840	NV	5.0
Benzo(b)fluoranthene	205992	0.029	5.0
Benzo(k)fluoranthene	207089	0.29	5.0
Benzo(a)pyrene	50328	0.0029	5.0
Indeno(1,2,3-cd)pyrene	193395	0.029	5.0
Dibenzo(a,h)anthracene	53703	0.0029	5.0
Benzo(g,h,i)perylene	191242	1,100	5.0
2,3,4,6-Tetrachlorophenol	58902	1100	5.0
Metals (ug/L) ILM05.4-ICP-AES Water			
Aluminum	7429905	37,000	200
Antimony	7440360	15	60
Arsenic	7440382	0.045	10
Barium	7440393	7,300	200
Beryllium	7440417	73	5
Cadmium	7440439	18	5
Calcium	7440702	NV	5,000
Chromium	7440473	0.43	10
Cobalt	7440484	11	50
Copper	7440508	1,500	25
Iron	7439896	26,000	100
Lead	7439921	15	10
Magnesium	7439954	NV	5,000
Manganese	7439965	880	15
Mercury	7439976	0.57	0.2
Nickel	7440020	730	40
Potassium	7440097	NV	5,000
Selenium	7782492	180	35
Silver	7440224	180	10
Sodium	7440235	NV	5,000

TABLE 3. GROUNDWATER LABORATORY ANALYTICAL SUMMARY
Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Target Analyte	CAS Number	Screening Criteria	Project Quantitation Limit
Thallium	7440280	NV	25
Vanadium	7440622	180	50
Zinc	7440666	11,000	60
Cyanide	57125	730	10

Notes

Groundwater samples will be compared to the Regional Screening Levels for Chemical Contaminants at Superfund Sites (May 2010) tap water values.

Acenapthylene criteria based on surrogate PAH Acenaphthene.

Benzo(g,h,i)perylene criteria based on surrogate PAH Pyrene.

Phenanthrene criteria based on surrogate PAH Anthracene.

NV - No Value Available for compound

Table 4. FIELD SAMPLE CONTAINER REQUIREMENTS

Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Sample Matrix	Fraction	Minimum Sample Volume	Container Type	Preservative	Technical Holding Time
A.) Low/Medium Concentration Organics:					
Aqueous	VOC	3 each (40-mL)	B	Hydrochloric acid (HCl) to pH<2, Cool 4°C	14 days
	BNA	2-Liter	H or J	Cool, 4°C	Extract in 7 days
Soil	VOC	3-cores, one-jar	5035*	Cool, 4°C	48 hours
	BNA	4-ounce	F or G	Cool, 4°C	Extract in 14 days
B.) Low/Medium Concentration Inorganics:					
Aqueous	Total Metals	1-Liter	C	Nitric acid (HNO_3) to pH<2, Cool, 4°C	6 months (mercury 28 days)
	Total Cyanide	1-Liter	C	Sodium Hydroxide (NaOH) to pH>12, Cool, 4°C	14 days
	Dissolved Metals	1-Liter	C	Nitric Acid to pH<2, Cool 4°C	6 months (mercury 28 days)
Soil	Total metals	8-ounce	F	Cool, 4°C	6 months

Notes:

Container Type (see Table 5).

* Containers to achieve requirements of Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition (SW-846) Method 5035 Closed-System Purge and Trap and Extraction for Volatile Organics in Soil and Waste Samples.

Table 5. SAMPLE CONTAINER TYPES
Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Container Type	Specifications	
B	Container Closure Septem	40-mL glass vial, 24-mm neck finish. Polypropylene or phenolic, open-top, screw cap, 15-cm opering, 24-400 size. 24-mm disc of 0.005-inch Teflon bonded to 0.120-inch silicon.
C	Container Closure	1-L high density polyethylene, cylinder-round bottle, 28-mm neck finish. Polyethylene cap, ribbed, 28-410 size; F217 polyethylene liner
F	Container Closure	8-ounce short, wide mouth, straight-sided, flint glass jar, 70-mm neck finish. Polypropylene or phenolic solid cap, 70-400 size; 0.015-inch Teflon liner.
G	Container Closure	4-ounce tall, wide mouth, straight-sided, flint glass jar, 48-mm neck finish. Polypropylene or phenolic solid cap; 48-400 size; 0.015-inch Teflon liner.
H	Container Closure	1-Liter, Boston round, glass bottle, 33-mm pour-out neck finish. Polypropylene or phenolic solid cap, 33-430 size; 0.015-inch Teflon liner.
J	Container Closure	32-ounce tall, wide mouth, straight-sided, flint glass, 89-mm neck finish. Polypropylene or phenolic cap cap, 89-400 size; 0.015-inch Teflon liner.

Table 6. FIELD AND MATRIX QC SAMPLES

Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

QC Sample	Number of Samples				Total QC Samples Collected
	Field Samples		QC Samples		
	Aqueous	Soil	Aqueous	Soil	
Field QC Samples:					
a.) Field Duplicate					
VOC	9	19	1	1	2
BNA	9	38	1	2	3
Metals	9	38	1	2	3
b.) Volatiles Trip Blank					
VOC Sample Cooler	N/A	N/A	5	N/A	5
c.) Equipment Blank (Rinsate)					
Direct Push	9	19	1	N/A	1
Matrix QC Samples					
a.) Matrix Spike and Matrix Spike Duplicate (MS/MSD)					
VOC	9	19	1	1	2
BNA	9	38	1	2	3
b.) Matrix Spike and Matrix Duplicate (MS/DUP)					
Metals	9	38	1	2	3
TOTAL					**22**

Notes:

Number of field QC samples to be collected based on the following:

Field duplicate based on 1 QC sample per 20 field samples per environmental media.

VOC trip blank based on 1 QC sample for each cooler containing VOC sample containers.

Equipment blank based on 1 QC sample per 20 field samples per environmental media.

1 sample container containing water will be placed in each cooler as a temperature blank.

Table 7. QC SAMPLING

Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Sample Type	Purpose	Collection	Sample Numbering
Field QC Samples:			
Field Duplicate	To check reproducibility of laboratory and field procedures. To indicate matrix non-homogeneity.	Collect from areas that are known or suspected to be contaminated. Collect one per week or one per 20 field samples per matrix, whichever is greater.	Assign two separate (unique) CLP sample numbers (i.e.,one number to the primary sample and one to the duplicate). Submit blind to the lab.
Volatiles Trip Blank	To check contamination during sample handling and shipment from field to laboratory.	Collect one sample (water demonstrted to be free of the contaminants of concern) per each sample cooler containing volatiles samples. The blank samples are prepared before sampling begins, and placed in the cooler used to ship volatile samples.	Assign separate CLP sample numbers to the trip blanks. Submit blind to the lab.
Equipment Blank or Rinse Blank	To check field decontamination procedures.	Collect when sampling equipment is decontaminated and reused in the field. Collect 1 per 20 field samples. Use blank water (water demonstrated to be organic-free, deionized, or distilled for organics) to rinse the equipment, and collect this rinse water into the sample container.	Assign separate CLP sample numbers to the equipment blanks. Submit blind to the lab.
Temperature Blank	To check temperature of the cooler during shipping upon arrival at the lab.	Collect 1 sample per cooler shipped to the lab. Use blank water (water demonstrated to be organic-free, dionized, or distilled for organics).	Do not assign separate CLP sample number. Note as "Temperature Blank" on label.
Matrix QC Samples:			
Organics			
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	Required by laboratory's contract to check accuracy and precision of organic analyses and matrix effect.	**Aqueous:** Collect triplicate volume (e.g. A PCB MS/MSD would be a total of 6 liters) **Solid:** Collect triplicate volume.	Not applicable, however the sample designated for Matrix QC must be documented as such on the TR/COC.
Inorganics			
Matrix Spike/ Matrix Duplicate (MS/DUP)	Required by laboratory's contract to check accuracy and precision of inorganic analyses and matrix effect.	**Aqueous:** Collect triplicate volume (e.g. Metals MS/DUP would be a total of 3 liters) **Solid:** Collect triplicate volume.	Not applicable, however the sample designated for Matrix QC must be documented as such on the TR/COC.

Table 8. Preventative Maintenance - Field Equipment
Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Instrument	Activity	Frequency
Digital Camera	Battery check	at the beginning of each day
Oakton Conductivity and Temperature Meter	Battery check	at the beginning of each day
Oakton pH Meter	Battery check	at the beginning of each day
GPS	Battery check	at the beginning of each day
Radios	Battery check	at the beginning of each day
Printer	Ink check	prior to mobilizing to site

Notes: Identify field equipment and/or systems requiring periodic preventive maintenance.
Describe the activity, such as check the battery, etc.

Table 9. Calibration and Corrective Action - Field Equipment

Libby Owens Ford Plant
Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Instrument	Calibration Standard(s)	Frequency Initial Calibration	Frequency Continuing Calibration	Acceptance Criteria	Corrective Action
Oakton Conductivity and Temperature Meter	certfied 1417 microsiemens	at the beginning of each day	every tenth reading	+/- 10%	Calibrate instrument and retest.
Oakton pH Meter	certfied 7.0 pH	at the beginning of each day	every tenth reading	+/- 10%	Calibrate instrument and retest.

Notes: Identify all tools, gauges, instruments, and other equipment used for data collection activities that must be calibrated to maintain performance within specified limits.

APPENDIX 1

HEALTH AND SAFETY PLAN

TRIAD ENGINEERING, INC.

HEALTH AND SAFETY PLAN

Libby Owens Ford Plant

Charleston, Kanawha County, West Virginia
CERCLIS WVD005008412

Triad Project 04-10-0052

Submitted to:

West Virginia Department of Environmental Protection
Office of Environmental Remediation
601 57th Street
Charleston, West Virginia 25304

Submitted by:

Triad Engineering, Inc.
4980 Teays Valley Road
Scott Depot, West Virginia 25560

July 2010

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1.0 PURPOSE AND SCOPE

This Site Specific Health and Safety Plan (HASP), describes health and safety procedures to be followed by Triad Engineering, Inc (TRIAD) employees and subcontractors for environmental sampling activities to be performed at the Libby Owens Ford Plant CERCLIS Site located in Charleston, Kanawha County, West Virginia.

This HASP has been prepared by the Project Health and Safety Coordinator (HSC) for use by TRIAD, and its designated representatives, including subcontractors. This HASP is a dynamic document and is intended to be modified if new or additional information becomes available regarding planned field activities or potential hazards that TRIAD may become aware of during the course of the project. It is the responsibility of the Project Manager (PM) to communicate any such additional information to the HSC, who will determine the need to modify or addend this HASP.

The project will consist of field work described within the Sampling and Analysis Plan (*SAP)* which includes the collection of soil and aqueous samples at the Libby Owens Ford Plant Site from the following environmental media:

- Surface Soil
- Subsurface Soil
- Groundwater

Sampling procedures are discussed in the *Field Sampling Plan (FSP)* portion of the *SAP*.

The objective of the HASP is to provide site workers with site-specific information and procedures to be followed to protect the health and safety of all site personnel during field work activities. It is designed to provide guidance in identifying, evaluating, and controlling safety and health hazards and in providing for emergency response at the Site during field operations. All work shall be performed in compliance with applicable Federal, State, and local regulations, and in particular with the provisions of OSHA 29 CFR 1910, Occupational Safety and Health Standards for General Industry.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Project Contacts

Contact: [redacted]
4980 Teays Valley Road
Scott Depot, West Virginia 25560
Phone: ([redacted]

Contact: [redacted]
4980 Teays Valley Road
Scott Depot, West Virginia 25560
Phone: ([redacted]

Contact: [redacted]
4980 Teays Valley Road
Scott Depot, West Virginia 25560
Phone: ([redacted]

2.1 PROJECT ORGANIZATION

Project Manager: [redacted]

The TRIAD Project Manager (“PM”) is responsible for overall coordination of site activities and changes in the scope of work. It is the responsibility of the PM to communicate any new or additional information concerning planned field activities or potential hazards to the HSC. The

PM will communicate any modifications to the HASP to all field personnel, including subcontractors. The PM will be responsible for seeing that all on-site personnel have received the required training and medical surveillance, and will monitor site operations for compliance with this HASP. The PM will assure that any required personal protective equipment (PPE) is available for project personnel.

Health and Safety Coordinator: [redacted]

The Health and Safety Coordinator is a resource for development of the site-specific HASP and will be consulted on health and safety issues that arise in the field. The Health and Safety Coordinator will make final decisions regarding questions on the HASP.

Field Team Leader: [redacted]

The Field Team Leader (FTL) will assist the Project Manager with coordinating field-related activities and maintaining field operations in accordance with project requirements. The FTL will make safety and health decisions according to guidelines in this HASP and will consult with the Health and Safety Director, if necessary. The FTL will assist with the implementation of this HASP, including site briefings, record keeping, and evaluation of site conditions. The FTL will also exercise stop-work authority if an unanticipated dangerous situation arises, maintain a first aid kit, and coordinate on-site safety with site operator(s). The FTL will assure that on-site personnel understand and perform their designated responsibilities and have the proper equipment and operations training.

3.0 HAZARD ANALYSIS

3.1 SITE DESCRIPTION

The Libby Owens Ford Plant (LOF) was a window glass manufacturing plant that operated from 1917 to 1980 on approximately 25 acres on the southern side of MacCorkle Avenue. This area is now occupied by the Kanawha Mall, Kroger, two banks (Chase and BB&T), several restaurants (including Burger King, Applebee's, Taco Bell, and La Caretta), and several retail stores (including a hair salon, movie store, and smoker friendly).

LOF also had an easement from the plant area to the Kanawha River along the Owens Illinois (OI) glass container plant. The Owens Illinois glass container plant operated from the early 1920's to the 1960's on approximately 37 acres on the northern side of MacCorkle Avenue. This area is now occupied by Lowes, several restaurants (including Cracker Barrel, Arby's, Pizza Hut), and a large warehouse. The West Virginia Housing Development Fund has entered 2.08 acres at the southwest corner of the area into the West Virginia Voluntary Remediation Program (WVVRP). It has also been reported that the 4.04 acre parcel currently owned by Emerald Coast Hospitality on the eastern portion of the area will also be entered into the WVVRP.

The Site is bound to the immediate north, northeast by the Kanawha River. The Site is bound to the immediate southwest by a CSX railway. The Site is bound to the immediate northwest by 57^{th} Street, further west are residential and commercial properties. The Site is bound to the immediate southeast by Interstate 77.

3.2 PHYSICAL HAZARDS

There are various physical hazards that field personnel may encounter. The following are the hazards potentially associated with this project:

- Lifting Hazards
- Heavy Equipment
- Uneven or Unstable Terrain (slip, trip, and fall hazards)
- Ambient Temperature Extremes (heat/cold stress)
- Inclement Weather
- Environmental Hazards
- Housekeeping
- Elevated Work
- Stress & Fatigue

- Noise Hazards (excess of 85 dBA)
- Underground Utilities

All physical hazards shall be addressed during the safety meeting prior to job commencement by the HSC/PM.

Lifting Hazards

The potential exists for workers to become injured while lifting or maneuvering heavy objects during the performance of various tasks. In addition, various tasks may require lifting heavy pieces of equipment. If objects are improperly lifted, debilitating back strain and/or other injuries may result. Site personnel should obtain help from others, employ proper lifting techniques, and use machinery where possible to assist when handling heavy objects.

Six-Step Technique for Lifting:

1. Keep feet parted-one alongside, one behind the object. (Lift with the legs)
2. Keep the back straight, nearly vertical.
3. Tuck in your chin.
4. Grip the object with the whole hand.
5. Tuck the elbows and arms in
6. Keep body weight directly over feet.

Heavy Equipment

Ground personnel shall communicate with the operator before entering and after exiting that operator's work area. The swing radius of any piece of equipment must be established and at no time are ground personnel to enter that area when the equipment is in operation. Only qualified personnel shall operate equipment.

Ambient Temperature Extremes (Heat/Cold Stress)

Ambient temperature extremes (hot/cold working environments) may occur during performance of this work. Work performed when the ambient air temperatures are below 40 F may result in varying levels of cold stress (frost bite, hypothermia) depending on environmental factors such as temperature, wind speed, and humidity, physiological factors such as metabolic rate and moisture content of the skin, and other factors such as work load and protective clothing being worn.

Work performed when the ambient air temperatures exceed 80° F may result in varying levels of heat stress (heat rash, heat cramps, heat exhaustion, and heat stroke) depending on environmental factors such as temperature, wind speed, and humidity; physiological factors such as metabolic rate and moisture content of the skin; and other factors such as work load and protective clothing being worn.

These conditions can be debilitating and, when extreme can be fatal. An understanding of the importance in preventing heat/cold stress coupled with the worker's awareness of the signs and symptoms of overexposure can significantly reduce the potential for adverse health effects.

See Attachment 1 for associated heat/cold stress information.

Stress and Fatigue

Stress and fatigue may become a factor during the course of this project. Extended hours worked by field personnel can be mentally and physically demanding. Field personnel should attempt to maintain a well balanced diet and get sufficient sleep. Consuming excessive amounts of alcohol can also contribute to stress and lack of hazard awareness. Over the counter medication can also affect one's ability to recognize potential hazards and should be taken with caution.

Noise Hazards (excess of 85 dBA)

Noise exposure exceeding the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) may be encountered during operation of mechanical equipment. Personnel who are repeatedly overexposed could experience a permanent reduction in their ability to hear normal conversation. Appropriate hearing protection shall be worn while the direct-push rig is in operation. It shall also be the responsibility of the PM to ensure that the application, use, and maintenance of occupational hearing protection are in accordance with policies established by TRIAD as well as OSHA 29 CFR 1910.95.

Underground Utilities

All underground utilities shall be identified prior to any intrusive work in the project area. A Miss Utility One-Call shall be completed and documented at least 3 days prior to initiation of subsurface work. Underground utilities shall not at any time be located by mechanically powered excavation equipment.

3.3 ENVIRONMENTAL HAZARDS

Rodents, snakes, stray animals, stinging insects, poison ivy/oak/sumac are all environmental hazards that may be encountered during daily site operations. A site investigation to identify these hazards prior to work related activities is essential. The information obtained can then be passed on to site personnel.

See Attachment 2 for associated Poison Ivy information.

Uneven/Unstable Terrain

Planned activities described in the scope of work will bring field personnel into areas where this potential hazard exists. These work areas shall be discussed as part of the safety briefing prior to the commencement of activities in that area.

Inclement Weather

As all work will be conducted outdoors, inclement weather may be encountered. As conditions may vary, it will be at the discretion of the PM to temporarily suspend or terminate activities as conditions dictate. In particular, electrical storms present significant threats when metallic boom equipment such as direct push rigs are present. All site operations will cease during storm events when lightning is observed.

Housekeeping

Good housekeeping is essential to the success of any project. Good housekeeping practices shall be maintained throughout the duration of the project. Items such as tools and any other equipment utilized during the course of the project shall be maintained in an orderly fashion so as to not pose a tripping hazard

3.4 CHEMICAL HAZARDS

Based on previous investigations and the historical operational activities performed at the Site, the following contaminants of potential concern (COPCs) have been identified at the Site:

- Metals
- VOC
- BNA

See Attachment 3 for associated chemical information.

To minimize the potential for site workers to encounter chemical hazards, care shall be taken so that no soil or other material is accidentally ingested. The PM will not permit eating, drinking, or tobacco use in or around work zones. All site personnel will thoroughly wash their hands and faces before eating, drinking, or smoking.

4.0 TRAINING

By signing this HASP, all personnel certify that they have completed the training required by OSHA 29 CFR 1910.120, including the annual updates, as necessary. By signing, personnel also certify they have read and understand this HASP, and will abide with all of its requirements and provisions.

5.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE shall be required for various field activities and will be selected to minimize the potential for chemical contamination through the following routes of exposure: inhalation, ingestion, injection, and absorption. Selection of PPE will be determined by the HSC in this HASP and may be modified during the course of the work by the PM only after consultation and approval by the HSC. In addition, PPE will also be selected to minimize exposure to physical hazards. All field personnel shall wear the following PPE:

- Inner Nitrile Gloves (while sampling)
- Work Gloves
- Steel Toe Boots with Steel Shanks that extend over the ankle
- Eye Protection at all times
- Hard Hats if working in areas with overhead hazards or if required by site specific rules
- Hearing protection while the direct-push rig is in operation

6.0 MEDICAL SURVEILLANCE

All personnel who may come in contact with hazardous materials during field operations shall be medically monitored under the TRIAD medical monitoring program, in accordance with OSHA 29 CFR 1910.120 (f). At no time during field operations may a TRIAD employee be present on-site without current medical monitoring status. Other subcontractors working on site will also comply with OSHA 1910.120 medical monitoring requirements.

7.0 AIR MONITORING

Periodic air monitoring utilizing a Photo Ionization Detector (PID) of certain sampling locations shall be performed to ensure no exposure over OSHA PELs are encountered with respect to volatile or semi-volatile organic compounds. Should PID reading of 5 parts per million (ppm) above background levels be encountered in the breathing zone at certain sampling locations site activities shall be terminated and the location re-evaluated with a higher level of protection. PID detectors utilize an ultraviolet light source to detect organic compounds in air. The light source (lamp) must be properly selected based on the photo ionization energies of the organic compounds present. (10.2 electron volts [eV] or 11.7 eV probe) By necessity, one must have knowledge of the contaminants on a site to select the proper probe.

8.0 SITE CONTROL MEASURES

Only designated and authorized personnel or subcontractors shall be permitted to enter the work zone. This shall be regulated by the PM. All personnel are to be in voice or visual contact with each other at all times. A visitor log will be maintained by the FTL during all site activities.

9.0 DECONTAMINATION

The PM will implement decontamination activities in accordance with the provisions of OSHA 29 CFR 1910.120(k) **Decontamination**. The PM will establish decontamination procedures in consultation with the HSC. Decontamination procedures shall be monitored by the PM to determine effectiveness.

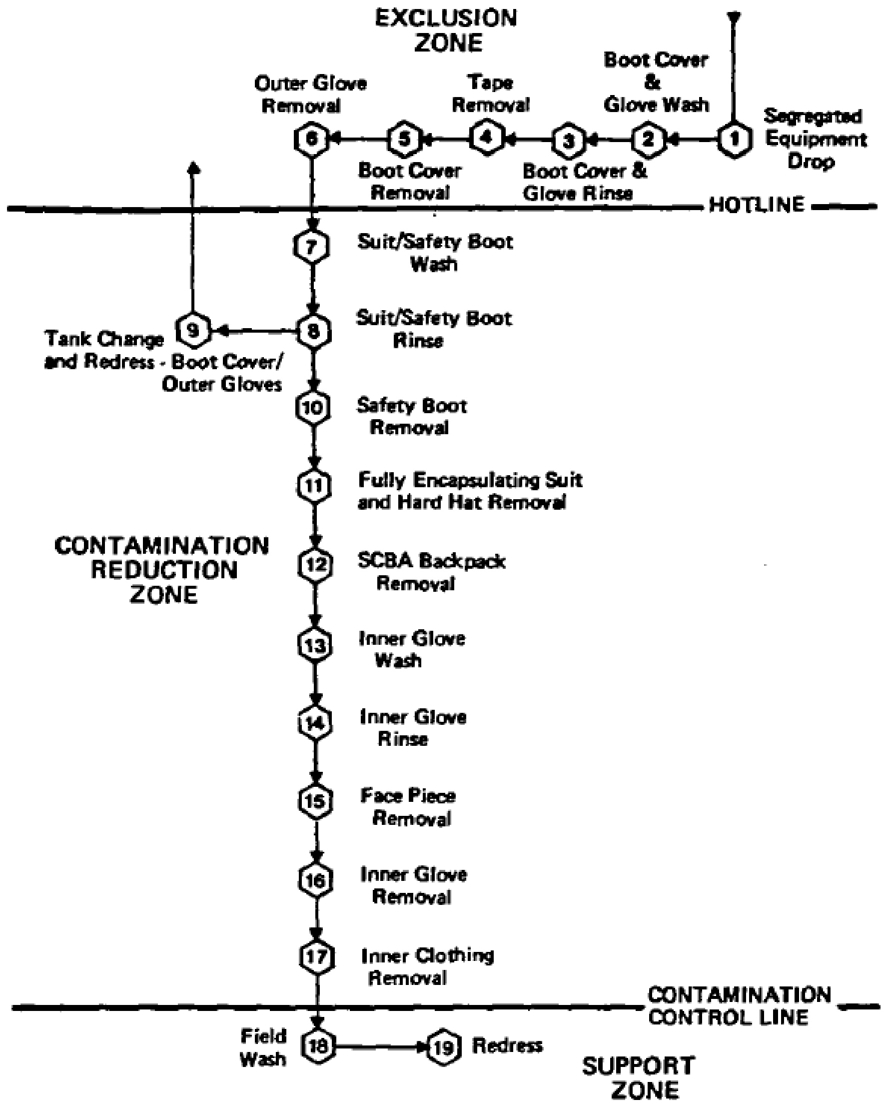
The objective of these procedures is to minimize the risk of exposure to hazardous substances. The procedures for decontaminating personnel upon leaving the contaminated area are addressed for each of the designated levels of protection. The procedures given are for the maximum and minimum amount of decontamination used for each level of protection (Level A, B, and C).

Decontamination lines are site specific since they are dependent upon the types of contamination on site. When the decontamination line is no longer required, contaminated wash and rinse solutions and contaminated articles must be contained and disposed of as hazardous waste in compliance with state and federal regulations.

Station layout for maximum decontamination:

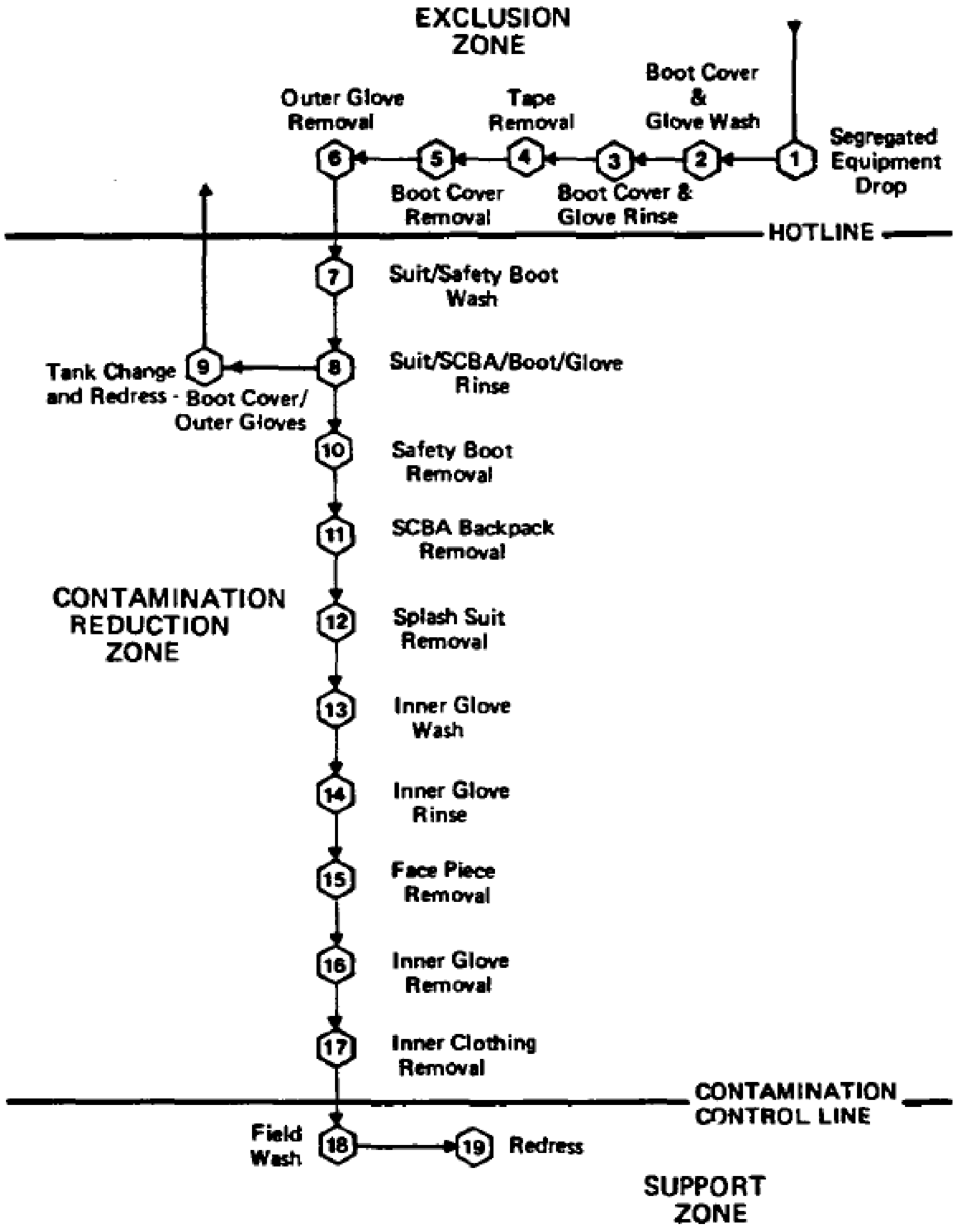
MAXIMUM DECONTAMINATION LAYOUT

LEVEL A PROTECTION



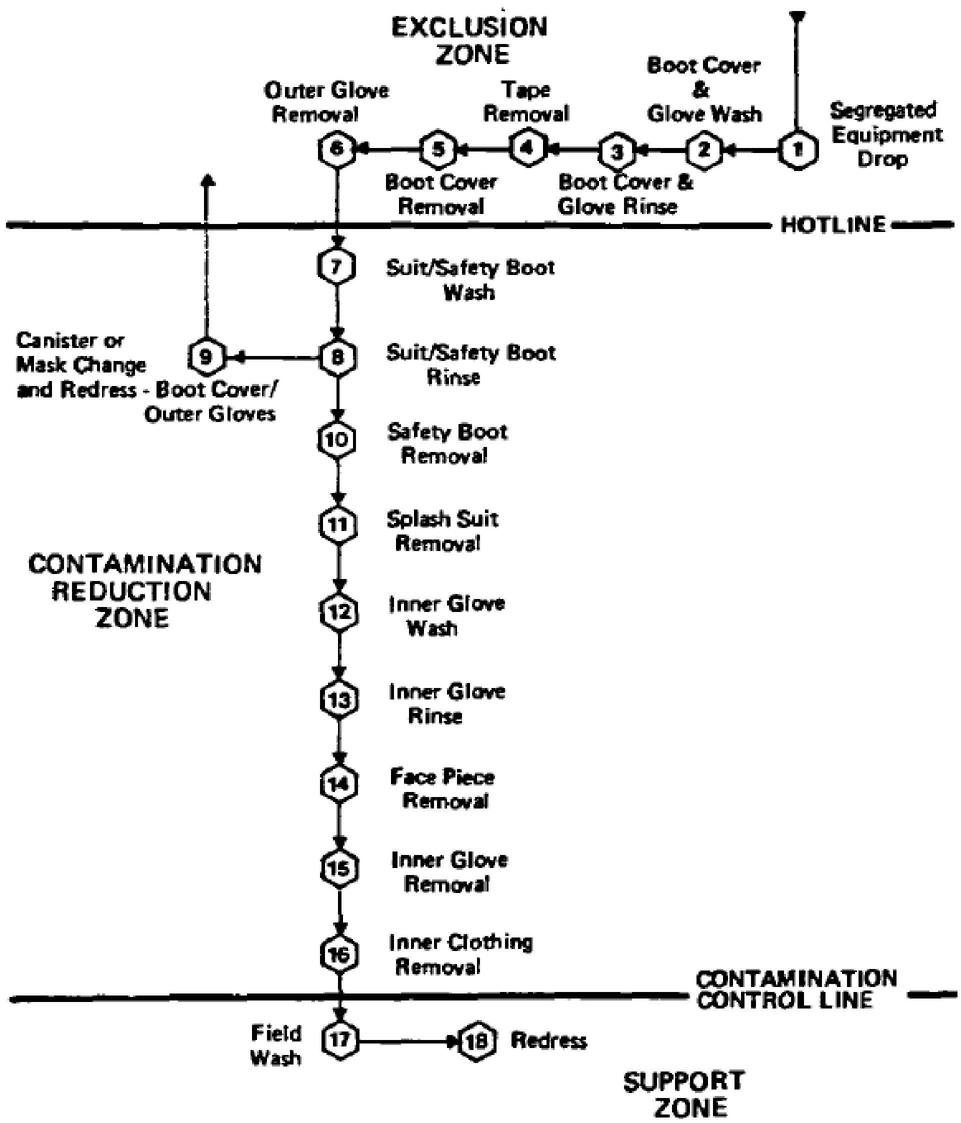
MAXIMUM DECONTAMINATION LAYOUT

LEVEL B PROTECTION



MAXIMUM DECONTAMINATION LAYOUT

LEVEL C PROTECTION



Components of decontamination shall include:

- The establishment of three defined zones, an Exclusion Zone (EZ), a Contamination Reduction Zone (CRZ), and a Support Zone (SZ)
- The number and layout of decontamination stations
- Decontamination equipment needed
- Appropriate decontamination methods
- Methods to minimize site personnel contact with contaminants during removal of PPE

Decontamination procedures shall be revised whenever the type of PPE or equipment changes, the site conditions change, or the site hazards are reassessed based on new information.

Decontamination zones will be located so as to minimize the potential for contamination. The location of these zones shall be determined based on site reconnaissance performed by the PM.

All field equipment and non-disposable PPE will be decontaminated before personnel exit the CRZ. Disposable PPE and decontamination water and/or debris will be placed into 55-gallon drums or other suitable containers, labeled as "Potential Hazardous Waste, Pending Analysis" and stored on-site pending laboratory analytical results.

Decontamination of the direct-push rig and rods shall be performed prior to any drilling activities. At a minimum decontamination shall consist of thoroughly washing the rods with a steam pressure washer prior to any direct push activities. All rods used for this project will be decontaminated after the completion of the final boring and prior to leaving the site. Decontamination water from this process shall be collected in 55 gallon drums.

10.0 EMERGENCY RESPONSE PLAN

In the event of a serious injury, fire, or other emergency, the PM or FTL shall notify emergency services by calling **911.** In the event that an injury is serious enough to require transport to the nearest hospital by ambulance, this need will be coordinated by the FTL. **All**

injuries of a serious or non-serious nature will immediately be reported to the PM and/or the HSC.

The nearest hospital is: **CHARLESTON AREA MEDICAL CENTER**
3200 MacCorkle Avenue
Charleston, WV

Attachment 4.0 identifies the location and the route to CHARLESTON AREA MEDICAL CENTER.

Emergency Room (304) 388-5432

The following is a list of phone numbers to be used in the event of an emergency:

Fire	911	
Ambulance	911	
PM/FTL	[redacted]	mobile: [redacted]
HSC	[redacted]	mobile: [redacted]

11.0 CONFINED SPACE ENTRY

TRIAD does not anticipate a confined space entry on this project.

12.0 SPILL CONTAINMENT

The only potential spill will be from water used for decontamination procedures. Liquids generated during decontamination will be containerized and staged on site pending later off-site disposal. Decontamination will occur in a designated area where spill controls are emplaced.

13.0 ADDITIONAL INFORMATION AND PROCEDURES

Weather conditions will be a factor. Extremes in temperature may result in excessive heat stress given the level of PPE to be worn. If at any time the PM or HSC deems working conditions hazardous (re: temperature and heat index), work will be stopped and the situation re-evaluated.

14.0 ACKNOWLEDGMENT

I hereby acknowledge that I have read this Health and Safety Plan, that I understand it, and that I agree to comply with its provisions.

NAME	SIGNATURE	DATE

ATTACHMENT 1.0

HEAT INDEX CHART

RELATIVE HUMIDITY (%)

°F	40	45	50	55	60	65	70	75	80	85	90	95	100
110	**136**												
108	**130**	**137**											
106	**124**	**130**	**137**										
104	**119**	**124**	**131**	**137**									
102	**114**	**119**	**124**	**130**	**137**								
100	**109**	**114**	**118**	**124**	**129**	**136**							
98	**105**	**109**	**113**	**117**	**123**	**128**	**134**						
96	**101**	**104**	**108**	**112**	**116**	**121**	**126**	**132**					
94	**97**	**100**	**102**	**106**	**110**	**114**	**119**	**124**	**129**	**135**			
92	**94**	**96**	**99**	**101**	**105**	**108**	**112**	**116**	**121**	**126**	**131**		
90	**91**	**93**	**95**	**97**	**100**	**103**	**106**	**109**	**113**	**117**	**122**	**127**	**132**
88	**88**	**89**	**91**	**93**	**95**	**98**	**100**	**103**	**105**	**110**	**113**	**117**	**121**
86	**85**	**87**	**88**	**89**	**91**	**93**	**95**	**97**	**100**	**102**	**105**	**108**	**112**
84	**83**	**84**	**85**	**86**	**88**	**89**	**90**	**92**	**94**	**96**	**98**	**100**	**103**
82	**81**	**82**	**83**	**84**	**84**	**85**	**86**	**88**	**89**	**90**	**91**	**93**	**95**
80	**80**	**80**	**81**	**81**	**82**	**82**	**83**	**84**	**84**	**85**	**86**	**86**	**87**

With Prolonged Exposure and/or Physical Activity

Extreme Danger: Heat Stroke Highly Likely

Danger: Heat Stroke, Heat Exhaustion, Muscle Cramps Likely
Caution: Heat Stroke, Heat Exhaustion, Muscle Cramps, and Fatigue Possible

Note: Heat Index values are devised for shady light wind conditions, exposure to full sunshine may increase these Heat Index values by 15° F.

Signs and Symptoms of Heat Stress:

Heat Rash may result from continuous exposure to heat or humid air.

Heat Cramps are caused by heavy sweating with inadequate electrolyte replacement.

Signs and symptoms include:

- Muscle spasms
- Pain in the hands, feet, and abdomen.

Heat Exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:

- Pale, cool, moist skin
- Heavy sweating
- Dizziness
- Nausea
- Fainting.

Heat Stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained.
Signs and symptoms are:

- Red, hot, usually dry skin
- Lack of or reduced perspiration
- Nausea
- Dizziness and confusion
- Strong, rapid pulse, or coma

Control Measures for Heat Stress:

- Provide adequate liquids to replace body fluids. Personnel must replace water and salt lost from sweating. Personnel must be encouraged to drink more than the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement

- Replacement fluids can be commercial mixes such as Gatorade (dilute if possible). Maintain water temperature at 50^{o} to 60^{o}F. Have site personnel drink 16 ounces of fluid preferably water before beginning work

- Establish a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts of workers

- Cooling devices such as cooling vests may be worn beneath protective garments

- Breaks are to be taken in a cool rest area
- Personnel shall remove impermeable protective garments during rest periods
- Personnel shall not be assigned other tasks during rest periods

COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED AS EQUIVALENT TEMPERATURE

Estimated Wind Speed	Actual Temperature Readings (^{o}F)						
	50	40	30	20	10	0	-10
Calm	50	40	30	20	10	0	-10
5	48	37	27	16	6	-5	-15
10	40	28	16	4	-9	-24	-33
15	36	22	9	-5	-18	-32	-45
20	32	18	4	-10	-25	-39	-53
25	30	16	0	-15	-29	-44	-59
30	28	13	-2	-18	-33	-48	-63
35	27	11	-4	-20	-35	-51	-67
40	26	10	-6	-21	-37	-53	-69
Wind speeds greater than 40 mph have little additional effect	LITTLE DANGER In <hr with dry skin Maximum danger of false sense of security				INCREASING DANGER Danger from freezing of exposed flesh within one minute		

Developed by U.S. Army Research Institute of Environmental Medicine

Physiological Factors:

- **Level of Acclimatization**-Cold acclimatization, which is much less profound than heat acclimatization, produces a lowered internal body temperature and an increased blood flow through the exposed extremities.

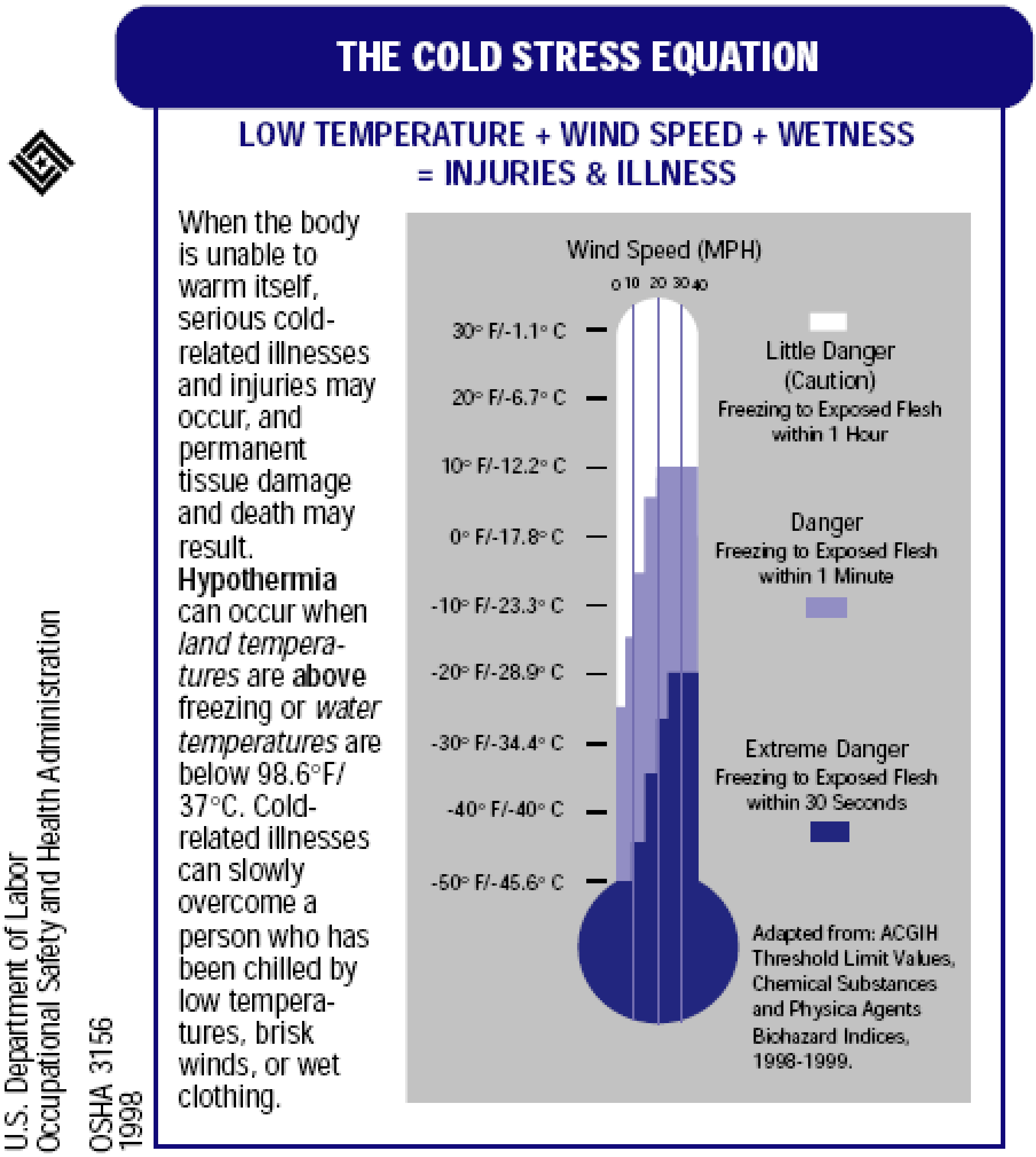
- **Physical Condition**-As with heat stress the greater the physical fitness level of the person, the more the worker will adapt to, and tolerate, both the heat and the cold.

- **Age**-Older workers with circulatory problems require special precautionary protection against cold injury.

- **Gender**-There are some fundamental physiological differences between sexes in thermal tolerance; however, these differences tend to combine during work in such a way as to minimize the difference in overall response.

- **Weight**-In the cold, size is usually an advantage because typically more heat is generated in the body, and the reduced surface area-to-mass ratio keeps the person warmer. However, as with heat tolerance there is much individual variation in the influence of this factor

COLD INDEX CHART



Signs and Symptoms of Cold Stress:

- **Frostnip**-Less severe than frostbite, it causes the skin to turn white and typically occurs on the face and other exposed parts of the body. There is no tissue damage with frostnip. However, if the exposed area is not either covered or removed from exposure to the cold, frostnip can become frostbite.

- **Trench Foot-**A condition that manifests itself as tingling, itching, swelling, and pain. If these symptoms are not treated, this condition can lead to serious injury including blistering, death of tissue, and ulceration. Trench foot is caused by continuous exposure of the feet simultaneously to a cold but not freezing environment and moisture.

- **Frostbite**-Frostbite is similar to burns in that it has three degrees:
  - With first degree frostbite there is freezing but no blistering or peeling
  - With second degree frostbite there is freezing accompanied by blistering and peeling
  - With third degree frostbite there is freezing accompanied by death of skin and/or tissue.

- The first sign of frostbite is typically a sensation of cold and numbness. These symptoms may be accompanied by tingling, stinging, aching, or cramps. Frostbite of the outer layer of skin results in a whitish, waxy look. Deep frostbite results in tissue that is cold, pale, and solid.

- **Hypothermia**-A condition that results when the body's core temperature drops to dangerously low levels. If the condition is not reversed, the patient likely freezes to death. Signs and symptoms are:

  - Uncontrolled shivering
  - Sensation of cold
  - Slow or irregular heartbeat
  - Slow, slurred speech
  - Incoherence and confusion
  - Irregular breathing
  - Memory lapses
  - Fatigue or listlessness
  - Exhaustion.

- A persons susceptibility to hypothermia is increased by sedative drugs and alcohol.
  - Sedatives interfere with the transmission of impulses from the nerve endings in the skin to the brain. This may cause a person to miss natural signs that they are in danger.
  - Alcohol dilates blood vessels near the skin surface. This in turn, increases the amount and rate of heat loss, which results in an even lower body

temperature.

Control Measures for Cold Stress:

- Personnel should learn the hazards associated with cold stress and the means to protect themselves and their fellow workers.
  - Wear appropriate protective clothing
  - Limit duration of exposure, be aware of actual temperature as well as wind chill factor, and seek heated shelter away from the wind for breaks
  - Drink warm drinks for fluid replacement (nonalcoholic, caffeine free) this is just as important in cold environments as it is in hot environments
  - Eat a properly balanced diet to ensure that the body is able to generate metabolic heat
  - Keep the feet and all extremities dry.

Physiological Factors:

- **Level of Acclimatization**-Cold acclimatization, which is much less profound than heat acclimatization, produces a lowered internal body temperature and an increased blood flow through the exposed extremities.

- **Physical Condition**-As with heat stress the greater the physical fitness level of the person, the more the worker will adapt to, and tolerate, both the heat and the cold.

- **Age**-Older workers with circulatory problems require special precautionary protection against cold injury.

- **Gender**-There are some fundamental physiological differences between sexes in thermal tolerance; however, these differences tend to combine during work in such a way as to minimize the difference in overall response.

Weight-In the cold, size is usually an advantage because typically more heat is generated in the body, and the reduced surface area-to-mass ratio keeps the person warmer. However, as with heat tolerance there is much individual variation in the influence of this factor.

ATTACHMENT 2

Poison Ivy Prevention

Most people are sensitive to, and have a reaction when exposed to poison ivy and other poison ivy types plants, avoiding them are important. But to avoid them, unless you plan on never going outside, you have to learn what they looks like.

To avoid these plants, in addition to the basic 'leaves of three, let it be', you should look for these characteristics of poison ivy, poison oak, and poison sumac:

Poison Ivy Identification

- frequently found around lakes and streams in the Midwestern and the Eastern parts of the United States and is also commonly found growing along trails and roadsides
- poison ivy grows as a woody, ropelike vine that can grow along fences or up trees, a trailing shrub on the ground, or a free-standing shrub
- it normally has three leaflets (groups of leaves all on the same small stem coming off the larger main stem), but may vary from groups of three to nine
- leaves are green in the summer and red in the fall
- yellow or green flowers and white berries

Poison Ivy Prevention

- **Avoid contact with plant by becoming familiar with on the identification of; poison ivy, poison oak, and poison sumac.**
- Wear long pants and long sleeve shirts when having to go into areas of poison ivy type plants.
- Use protective skin wipes: Pre-Contact and Cleanser Towelettes.
- **DON'T BE TOUCHY -** You can spread urushiol-containing oils from one area of your body to others if you touch the contaminated area and get oils on your hands.
- **Give yourself, clothing and tools a good wash — quickly. U**se dish soap to remove all of the poison ivy, as dish soap is made to remove grease and oils, which includes poison ivy oil

ATTACHMENT 3. Contaminants of Potential Concern

CHEMICAL NAME	PHYSICAL DESCRIPTION	EXPOSURE ROUTES	SYMPTOMS	FIRST AID	EXPOSURE LIMITS (TWA)
Arsenic	Silver-gray or tin-white, brittle, odorless solid	Inhalation, Absorption, Ingestion, Injection	Irritant to skin and eyes (lung and lymphatic cancer)	Flush eyes, soap wash of skin	0 5 mg/m^3
Cadmium	Silver-white, blue-tinged lustrous, odorless solid	Inhalation, Absorption, Ingestion, Injection	Cough, chest pains, chills, muscle aches, nausea, vomiting, diarrhea	Flush eyes, wash skin, respiratory support, medical attention	0 005 mg/m3
Lead	Heavy, ductile, soft, gray solid	Inhalation, Absorption, Ingestion, Injection	Irritant to skin and eyes (lung and lymphatic cancer)	Flush eyes, wash skin, respiratory support, medical attention	0 050 mg/m3
Selenium	Amorphous or crystalline, red to gray solid	Inhalation, Absorption, Ingestion, Injection	Irritant to skin and eyes, visual disturbance, headache, chills, fever,	Flush eyes, soap wash of skin, respiratory support	0 2 mg/m2
Trichloroethene	Colorless liquid (unless dyed blue) with a chloroform like odor	Inhalation, Absorption, Ingestion, Injection	Irritant to eyes and skin, headache, visual disturbance, drowsiness, nausea	Flush eyes, soap wash of skin, respiratory support	1000 ppm

Information obtained from the NIOSH Pocket Guide to Chemical Hazards

ATTACHMENT 4

1. Start out going NORTHEAST on 57TH ST SE toward MACCORKLE AVE SE/WV-61. 0.1mi

2. Turn LEFT onto MACCORKLE AVE SE/WV-61. 2.3 mi

3. 3200 MACCORKLE AVE SE is on the RIGHT.

APPENDIX 2-7

STANDARD OPERATING PROCEDURES

TRIAD ENGINEERING, INC.

<u>SURFACE SOIL COLLECTION</u>

TRIAD ENGINEERING, INC.
STANDARD OPERATING PROCEDURE
Prepared July 2010

Our personnel will procure each surface soil sample (0-2 feet below ground surface) using the following procedure:

<u>Equipment:</u>

Disposable plastic polyethylene <u>or</u> stainless steel scoops can be used for:

- Metals
- Polynuclear Aromatic Hydrocarbons (PAH)
- Pesticides
- Herbicides
- Polychlorinated Biphenyls (PCBs)
- Diesel Range Organics (DRO)
- Oil Range Organics (ORO)
- Phenols
- Moisture Content

Clean Stainless Steel scoops should be used for:

- Base-Neutral Compounds (a fraction of Semi-VOC that includes phthalates)
- Dioxin

Volatile Organic Compounds (VOC) including Gasoline Range Organics (GRO) will follow approved USEPA SW-846 Method 5035, *Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples* sample collection procedures. Refer to the *Method 5035 Standard Operating Procedure*. See figures below for typical Method 5035 sampling equipment:

Air-tight intermediate sample containers (such as EnCore® samplers)

Chemically preserved soil kit with disposable plastic syringe

All non-disposable sampling equipment which comes in contact with the sample will be decontaminated before and after each use.

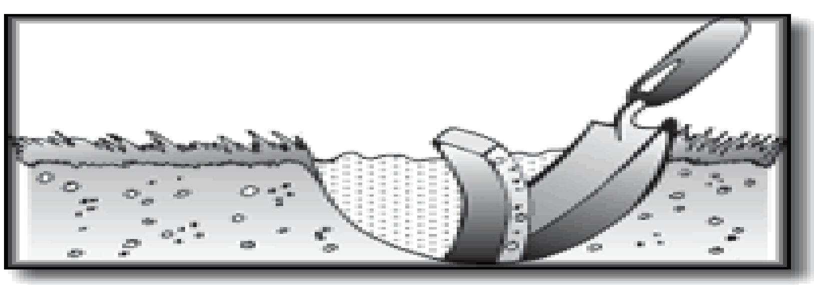
<u>Sampling Technique:</u>

1. Personal protective equipment (PPE) shall be worn during sample collection activities such as disposal nitrile gloves and safety glasses at a minimum.

2. Surface soil samples will be collected from not more than the upper two feet of soil at each sampling location.

3. If possible, select an area with few rocks, pebbles, and organic material.

4. Soil samples for analysis of constituents OTHER THAN VOCs must be homogenized to create a representative sample. Using a scoop (see Equipment above for which type to use), scoop the soil samples to be homogenized.



The goal of homogenization is to achieve a consistent physical appearance over the entire soil sample. Homogenization can be performed either in-situ or in a decontaminated stainless-steel or glass mixing bowl/tray.

Prior to homogenization, twigs, roots, leaves, rocks, and miscellaneous debris should be removed from the sample using a decontaminated stainless-steel scoop/spatula or a dedicated, disposable plastic sampling scoop.

Conduct homogenization by mixing the sample and then quartering the sample either in-situ or in the bowl. Once quartered, mix each quarter individually and then roll the quarters to the center and mix the entire sample again. This process should be repeated at least twice. Care should be taken to minimize contact of disposable gloves worn during sampling with soil to be sent to the laboratory.

5. Once a consistent physical appearance over the entire sample has been obtained, transfer appropriate volumes of soil into certified clean, laboratory-supplied, preserved (if necessary) bottle ware with either a decontaminated stainless steel or glass scoop/spatula or a dedicated, disposable plastic sampling scoop.

6. If Method 5035 is required, submerge the coring device directly into the soil prior to homogenizing the surface soil.

   Note: If Method 5035 air-tight intermediate sample containers (such as EnCore® samplers) are used, immediately seal the container, label, bag, and place on ice.

7. Seal each container, label, and place on ice.

8. The sample should be visually classified in accordance with the unified soil classification system (USCS). See **Table 1** for a summary of the field identification tests.

9. Once the sampling is completed, dispose of disposable scoops and Method 5035 plastic syringes. Decontaminate any stainless steel scoops before next use.

Record:

- *location,*
- *depth of sample,*
- *soil type, description (see **Table 1, Summary of Field Identification Tests**),*
- *equipment used,*
- *soil type and/or description if known,*
- *apparent moisture content (sample dry, moist, or wet),*
- *color, and*
- *any odor.*

Note:
If an equipment blank is to accompany the samples to the laboratory for analysis, collect one blank for every twenty samples collected by this procedure, only if stainless steel scoops are used. This is done in order to demonstrate cross-contamination of samples has not occurred during the sample collection process. The blank is collected by first decontaminating the stainless steel scoops, and then pouring de-ionized (DI) water over the equipment directly into the appropriate containers until they are filled.

Table 1. Summary of Field Identification Tests

<table>
<tr><td rowspan="8">COARSE-GRAINED SOILS
More than half the material (by weight) is individual grains visible to the naked eye</td><td rowspan="4">GRAVELLY SOILS
More than half of coarse fraction is larger than 4.75 mm</td><td colspan="2" rowspan="2">CLEAN GRAVELS
Will not leave a stain on a wet palm</td><td colspan="3">Substantial amounts of all grain particle sizes</td><td>GW</td></tr>
<tr><td colspan="3">Predominantly one size or range of sizes with some intermediate sizes missing</td><td>GP</td></tr>
<tr><td colspan="2" rowspan="2">DIRTY GRAVELS
Will leave a stain on a wet palm</td><td colspan="3">Non-plastic fines (to identify, see ML below)</td><td>GM</td></tr>
<tr><td colspan="3">Plastic fines (to identify, see CL below)</td><td>GC</td></tr>
<tr><td rowspan="4">SANDY SOILS
More than half of coarse fraction is smaller than 4.75 mm</td><td colspan="2" rowspan="2">CLEAN SANDS
Will not leave a stain on a wet palm</td><td colspan="3">Wide range in grain size and substantial amounts of all grain particle sizes.</td><td>SW</td></tr>
<tr><td colspan="3">Predominantly one size or a range of sizes with some intermediate sizes missing</td><td>SP</td></tr>
<tr><td colspan="2" rowspan="2">DIRTY SANDS
Will leave a stain on a wet palm</td><td colspan="3">Non-plastic fines (to identify, see ML below)</td><td>SM</td></tr>
<tr><td colspan="3">Plastic fines (to identify, see CL below)</td><td>SC</td></tr>
<tr><td rowspan="5">**FINE-GRAINED SOILS**

More than half the material (by weight) is individual grains not visible to the naked eye

(<0.074 mm)</td><td>**Ribbon**</td><td>**Liquid Limit**</td><td>**Dry Crushing Strength**</td><td>**Dilatancy Reaction**</td><td>**Toughness**</td><td>**Stickiness**</td><td></td></tr>
<tr><td>None</td><td><50</td><td>None to Sight</td><td>Rapid</td><td>Low</td><td>None</td><td>ML</td></tr>
<tr><td>Weak</td><td><50</td><td>Medium to High</td><td>None to Very Slow</td><td>Medium to High</td><td>Medium</td><td>CL</td></tr>
<tr><td>Strong</td><td>>50</td><td>Slight to Medium</td><td>Slow to None</td><td>Medium</td><td>Low</td><td>MH</td></tr>
<tr><td>Very Strong</td><td>>50</td><td>High to Very High</td><td>None</td><td>High</td><td>Very High</td><td>CH</td></tr>
<tr><td>**HIGHLY ORGANIC SOILS**</td><td colspan="6">Readily identified by colour, odour, spongy feel and frequently by fibrous texture</td><td>OL
OH
Pt</td></tr>
</table>

<u>DIRECT-PUSH SUBSURFACE SOIL COLLECTION</u>

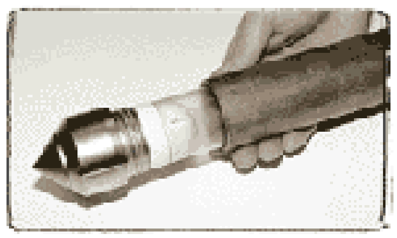
TRIAD ENGINEERING, INC.
STANDARD OPERATING PROCEDURE
Prepared July 2010

Subsurface soils are defined as those soils two feet or more below the ground surface.

Our personnel will procure each direct-push (also referred to as Geoprobe®) subsurface soil sample using the following procedure:

1. Personal protective equipment (PPE) shall be worn during drilling activities such as gloves, safety glasses, hard hats, hearing protection, and steel toed boots at a minimum.

2. Subsurface soil will be collected by a direct-push rig drilling continuous subsurface soil cores using two-inch diameter acetate sleeves encased in a stainless steel rod.

   Note: If contamination is suspect or observed in a perched aquifer during drilling, DO NOT push through into the next groundwater aquifer as you may introduce contamination.

3. Verify the objectives of the *Field Sampling Plan* in regards to subsurface soils by answering the following questions:
   - Is the sample a grab or composite?
   - Is the depth of soil to be collected defined?
   - Is sample depth to be collected determined by contamination (i.e. staining, odor, and/or PID/FID reading)?
   - Is sample depth to be collected at the water table? Perched or alluvial?
   - Is sample depth to be collected at bedrock or refusal (i.e. as deep as the drill rig can go)?

4. Each acetate sleeve core will be brought to the surface and cut open to expose the subsurface soil.

   Note: Screening and sub-sampling should occur immediately following the core being brought to the surface.

5. If petroleum or volatile organic compounds (VOCs) are contaminants of potential concern, it is recommended each core be field screened using a photoionization detector (PID) or a flame ionization detector (FID).

6. The cores should be visually classified in accordance with the unified soil classification system (USCS). See **Table 1** for a summary of the field identification tests.

7. Determine which sampling equipment is appropriate to sub-sample the core according to the following:

   <u>Equipment:</u>
   Clean Stainless Steel scoops should be used for:
   - Base-Neutral Compounds (a fraction of Semi-VOC that includes phthalates)
   - Dioxin

   Disposable plastic polyethylene <u>or</u> stainless steel scoops can be used for:
   - Metals
   - Polynuclear Aromatic Hydrocarbons (PAH)
   - Pesticides
   - Herbicides
   - Polychlorinated Biphenyls (PCBs)
   - Diesel Range Organics (DRO)
   - Oil Range Organics (ORO)
   - Phenols
   - Moisture Content

   Volatile Organic Compounds (VOC) including Gasoline Range Organics (GRO) <u>should be collected first</u> and will follow approved USEPA SW-846 Method 5035, *Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples* sample collection procedures. Refer to the *Method 5035 Standard Operating Procedure*. See figures below for typical Method 5035 sampling equipment:

Air-tight intermediate sample containers (such as EnCore® samplers)

Chemically preserved soil kit with disposable plastic syringe

Sampling Technique:

8. If possible, avoid or remove rocks, pebbles, and organic material from the core sample to be collected.

9. PPE shall be worn during sample collection activities such as disposal nitrile gloves and safety glasses at a minimum.

10. Using the appropriate sub-sampling equipment, (see Equipment above for which type to use), scoop the soil into a decontaminated stainless-steel or glass mixing bowl/tray. Conduct homogenization by mixing the sample and then quartering the sample. Once quartered, mix each quarter individually and then roll the quarters to the center and mix the entire sample again. This process should be repeated at least twice. Care should be taken to minimize contact of disposable gloves worn during sampling with soil to be sent to the laboratory.

11. Once a consistent physical appearance over the entire sample has been obtained, transfer appropriate volumes of soil into certified clean, laboratory-supplied, preserved (if necessary) bottle ware with either a decontaminated stainless steel or glass scoop/spatula or a dedicated, disposable plastic sampling scoop.

12. If Method 5035 is required, submerge the coring device directly into the soil prior to homogenizing the surface soil.

13. Seal each container, label, and place on ice.

14. Once the sampling is completed, the direct-push operator will fill the hole with bentonite chips and/or soil cuttings. The stainless steel rods, drive point assembly, and stainless steel scoops will be decontaminated and the acetate sleeves, Method 5035 plastic syringes, and plastic scoops disposed of.

Record:

- *depth of sample at point of collection in feet below ground surface (bgs),*
- *soil type, description, and/or stratification (see* ***Table 1, Summary of Field Identification Tests****),*
- *result of field screening (PID/FID),*
- *sample collection equipment used,*
- *if groundwater was encountered and at what depth,*
- *if bedrock or refusal was encountered and at what depth,*
- *apparent moisture content (sample dry, moist, or wet),*
- *any discoloration or staining, and*
- *any odor.*

Note:

If an equipment blank is to accompany the samples to the laboratory for analysis, collect one blank for every twenty samples collected by this procedure. This is done in order to demonstrate cross-contamination of samples has not occurred during the drilling and sample collection process. The blank is collected by first decontaminating the steel rods, drive point assembly, and stainless steel scoops, and then pouring de-ionized (DI) water over the equipment directly into the appropriate containers until they are filled.

Table 1. Summary of Field Identification Tests

<table>
<tr><td rowspan="8">COARSE-GRAINED SOILS
More than half the material (by weight) is individual grains visible to the naked eye</td><td colspan="2" rowspan="4">GRAVELLY SOILS
More than half of coarse fraction is larger than 4.75 mm</td><td colspan="2" rowspan="2">CLEAN GRAVELS
Will not leave a stain on a wet palm</td><td colspan="2">Substantial amounts of all grain particle sizes</td><td>GW</td></tr>
<tr><td colspan="2">Predominantly one size or range of sizes with some intermediate sizes missing</td><td>GP</td></tr>
<tr><td colspan="2" rowspan="2">DIRTY GRAVELS
Will leave a stain on a wet palm</td><td colspan="2">Non-plastic fines (to identify, see ML below)</td><td>GM</td></tr>
<tr><td colspan="2">Plastic fines (to identify, see CL below)</td><td>GC</td></tr>
<tr><td colspan="2" rowspan="4">SANDY SOILS
More than half of coarse fraction is smaller than 4.75 mm</td><td colspan="2" rowspan="2">CLEAN SANDS
Will not leave a stain on a wet palm</td><td colspan="2">Wide range in grain size and substantial amounts of all grain particle sizes.</td><td>SW</td></tr>
<tr><td colspan="2">Predominantly one size or a range of sizes with some intermediate sizes missing</td><td>SP</td></tr>
<tr><td colspan="2" rowspan="2">DIRTY SANDS
Will leave a stain on a wet palm</td><td colspan="2">Non-plastic fines (to identify, see ML below)</td><td>SM</td></tr>
<tr><td colspan="2">Plastic fines (to identify, see CL below)</td><td>SC</td></tr>
<tr><td rowspan="5">**FINE-GRAINED SOILS**

More than half the material (by weight) is individual grains not visible to the naked eye

(<0.074 mm)</td><td>**Ribbon**</td><td>**Liquid Limit**</td><td>**Dry Crushing Strength**</td><td>**Dilatancy Reaction**</td><td>**Toughness**</td><td>**Stickiness**</td><td></td></tr>
<tr><td>None</td><td><50</td><td>None to Sight</td><td>Rapid</td><td>Low</td><td>None</td><td>ML</td></tr>
<tr><td>Weak</td><td><50</td><td>Medium to High</td><td>None to Very Slow</td><td>Medium to High</td><td>Medium</td><td>CL</td></tr>
<tr><td>Strong</td><td>>50</td><td>Slight to Medium</td><td>Slow to None</td><td>Medium</td><td>Low</td><td>MH</td></tr>
<tr><td>Very Strong</td><td>>50</td><td>High to Very High</td><td>None</td><td>High</td><td>Very High</td><td>CH</td></tr>
<tr><td>**HIGHLY ORGANIC SOILS**</td><td colspan="6">Readily identified by colour, odour, spongy feel and frequently by fibrous texture</td><td>OL
OH
Pt</td></tr>
</table>

<u>METHOD 5035 SAMPLE COLLECTION</u>

TRIAD ENGINEERING, INC.
STANDARD OPERATING PROCEDURE
Prepared July 2010

Our personnel will procure each soil or sediment sample for **Volatile Organic Compounds (VOC) or Gasoline Range Organics (GRO)** following the approved USEPA SW-846 Method 5035, *Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples* sample collection procedure:

<u>Equipment:</u>

Verify in the *Field Sampling Plan* or with the Field Operations Manager (FOM) which sampling equipment is required.

There are two types of Method 5035 equipment used: (1) Air-tight intermediate sample containers (such as EnCore® samplers) or (2) Chemically preserved soil kit with a disposable plastic syringe.

Both sampling techniques are outlined in this *Standard Operating Procedure*.

<u>Sampling Technique using the Air-tight Intermediate Sample Containers (such as EnCore® samplers)</u>

Examples of Air-tight intermediate sample containers (such as EnCore® samplers)

1. <u>Before sampling</u>, ensure each kit has at a minimum one (1) T-handle tool, three (3) core samplers designed to collect a five gram sample each, (3) core sampler caps to seal the core samplers, and one (1) two or four once glass jar for moisture content determination. <u>If the kit is incomplete, notify the Field Operation Manager (FOM) before proceeding</u>.

2. Personal protective equipment (PPE) shall be worn during sample collection activities such as disposal nitrile gloves at a minimum.

3. Load core sampler into the 5035 T-handle tool.

4. Plunge the core body of the sampler directly into the soil or sediment until the sampler is full. Take special care not to include rocks and twigs in the sample collected.

5. Remove the coring body from the soil or sediment and attach the sealing cap.

6. Remove the T-handle and return the core sampler to its individual zip lock bag.

7. Collect three core samplers per location.

8. Using a disposable plastic scoop, collect a separate two or four ounce container of sample to be submitted to the laboratory for moisture content determination.

9. Place the three core samplers and moisture content jar in a zip-lock bag, seal, and label. Store immediately on ice for transport to the laboratory.

10. Dispose of the disposable plastic scoop.

Sampling Technique using the Chemically Preserved Soil Kit with Disposable Plastic Syringe

Examples of chemically preserved soil kit with disposable plastic syringe

1. Before sampling, ensure each kit has at a minimum one (1) disposable plastic syringe designed to deliver a five gram sample, two (2) pre-weighed vials preserved with sodium bisulfate with a stir bar in each, one (1) pre-weighed vial preserved with methanol, and one (1) two or four once glass jar for moisture content determination. If the kit is incomplete, notify the Field Operation Manager (FOM) before proceeding.

2. PPE shall be worn during sample collection activities such as disposal nitrile gloves and safety glasses at a minimum.

3. Using the syringe provided, plunge directly into the soil or sediment until the syringe is full. Take special care not to include rocks and twigs in the sample collected.

   Note: Soil or sediment volume collected should be equivalent in size to the top digit of an adult thumb.

4. Open one of the chemically preserved vials and insert the syringe.

5. Eject the soil core into the vial, seal, and shake well.

6. Repeat, filling each vial in the kit.

   Note: If the sodium bisulfate preserved vials effervesce, discard.

7. Using a disposable scoop, collect a separate two or four ounce container of sample to be submitted to the laboratory for moisture content determination.

8. Label each vial and jar and place immediately on ice.

9. Discard the disposable plastic syringe and scoop.

Record:

- *location,*
- *equipment used,*
- *soil type and/or description,*
- *color, and*
- *any odor.*

Note:
An equipment blank is not needed if only clean disposable equipment was used.

<u>DIRECT-PUSH VIA CHECK VALVE GROUNDWATER COLLECTION</u>

TRIAD ENGINEERING, INC.
STANDARD OPERATING PROCEDURE
Prepared July 2010

Our personnel will procure each direct-push (also referred to as Geoprobe®) groundwater sample using the following procedure:

1. Verify in the *Field Sampling Plan* or with the Field Operations Manager (FOM) whether the groundwater sample is to be perched or alluvial and whether or not filtering of the sample is required.

   Note: If contamination is suspect or observed in a perched aquifer during drilling, DO NOT push through into the next groundwater aquifer as you may introduce contamination.

   Note: Due to the intrusive nature of this collection procedure, solids (i.e. turbidity) that are not representative of the groundwater's natural condition are introduced into the sample. Therefore, filtering of direct-push groundwater samples for metals, or other contaminants that tend to adhere to solids, is recommended. Consult with the FOM for a decision.

2. Personal protective equipment (PPE) shall be worn during drilling activities such as gloves, safety glasses, hard hats, hearing protection, and steel toed boots at a minimum.

3. PPE shall be worn during sample collection activities such as disposal nitrile gloves and safety glasses at a minimum.

4. A decontaminated stainless steel perforated well screen attached to the bottom of the direct-push rods will be inserted into the boring.

5. Clean, un-used, polyethylene tubing with a decontaminated stainless steel check valve would then be lowered down through the rods into the groundwater.

6. Groundwater would be brought to the surface by lifting and lowering the tubing into the groundwater.

7. Once groundwater is brought to the surface, fill appropriate sample containers, seal, label, and place on ice. Take care not to overfill and potentially dilute preservatives.

8. The direct-push operator will remove the rods and tubing and will fill the hole with bentonite chips and/or soil cuttings. The stainless steel rods, drive point assembly, and check valve will be decontaminated and the tubing disposed of.

<u>Note:</u>
At a minimum, groundwater temperature, pH, and specific conductivity will be measured and recorded during sampling. To minimize the potential for cross-contamination, these measurements will be made on aliquots that are not to be submitted to the laboratory for analysis.

Record:
- *depth of groundwater,*
- *if location recharges quickly or not,*
- *soil type or description if known,*
- *general statement of turbidity (slight, moderate, or high),*
- *any discoloration, and*
- *any odor.*

If an equipment blank is to accompany the samples to the laboratory for analysis, collect one blank for every twenty samples collected by this procedure. This is done in order to demonstrate cross-contamination of samples has not occurred during the drilling and sample collection process. The blank is collected by first decontaminating the stainless steel well screen and check valve, and then pouring de-ionized (DI) water over the equipment directly into the appropriate containers until they are filled.

<u>AQUEOUS VOC AND GRO SAMPLE COLLECTION</u>

TRIAD ENGINEERING, INC.
STANDARD OPERATING PROCEDURE
Prepared July 2010

Aqueous samples to be analyzed for **Volatile Organic Compounds (VOC) or Gasoline Range Organics (GRO)** will be collected to prevent bio-degradation using the following zero head space, hydrochloric acid preservation procedure:

<u>Required Containers for Each Sample Location:</u>

Minimum two 40 milliliter glass vials with Teflon® sealed caps. Vials must be pre-cleaned and certified free of VOCs.

Example of typical vial for VOC and GRO sample collection.

<u>Preservation:</u>

1. If the vials are purchased pre-preserved with concentrated hydrochloric acid (HCl), skip these steps.

2. If the vials are not purchased pre-preserved, add two to three drops of 1:1 hydrochloric acid to each empty vial.

<u>Sample Collection:</u>

3. Personal protective equipment (PPE) shall be worn during sample collection activities such as disposal nitrile gloves and safety glasses at a minimum.

4. Slowly fill the vials, taking care not to force out the preservative.

5. Slightly overfill each vial to form a meniscus.

6. Tightly cap each vial and invert.

7. Tap the sides of the vial to check for trapped air bubbles in the sample.

8. If air bubbles are present, place the vial in an upright position and open cap. Repeat steps 3 through 7.

9. If air bubbles are still present, discard the sample and resample, completing all steps until there are no visible air bubbles.

Note: Some media effervesce when added to acid; if this is the case, a lack of air bubbles may be impossible. If this occurs, document in the field notes and submit to the laboratory with bubbles present. Estimate the size of the bubbles in the field notes.

10. Label and immediately place samples on ice.

<u>DISSOLVED METALS IN GROUNDWATER COLLECTION</u>

TRIAD ENGINEERING, INC.
STANDARD OPERATING PROCEDURE
Prepared April 2005

Groundwater samples that will be analyzed for dissolved (also known as filtered) metals will be collected by using the following groundwater filtering procedure:

1. Personal protective equipment (PPE) shall be worn during sample collection activities such as disposal nitrile gloves and safety glasses at a minimum.

2. From the collection device (i.e. bailer, low-flow cell, or direct-push tubing), immediately fill a plastic <u>unpreserved</u> sample container if using a filtering apparatus or attach a filter directing to the low-flow cell tubing or direct-push tubing and immediately fill into a preserved sample container.

3. When using a filtering apparatus, designate an area where the filtration process will be performed. The area must have a dust-free environment. When the filtration apparatus is not in use, keep it covered with aluminum foil or sealed plastic bag to protect from airborne particles. Use either a glass or plastic filtering apparatus that has been decontaminated. Stainless steel is unacceptable since it can contaminate the samples.

4. Filtration must be initiated immediately after sample collection. Filtration must be completed <u>before</u> preservation to a pH of less than 2.

5. The following are recommended filter specifications:

    a. <u>A 0.45 micron pore size</u>. Other pore size filters may be appropriate for site-specific conditions. However, deviations from the 0.45 micron pore size must be justified and documented in the field log book.

    b. <u>Certified pre-cleaned disposable polycarbonate membrane type filter</u>. If the filter is not certified pre-cleaned, each filter and filtration apparatus must be prepared before use since they often contain trace amounts of metals. Filtrations with approximately 20 milliliter of a 25 percent nitric acid solution (three parts water and one part concentrated nitric acid) followed by three, 20 milliliter rinses of trace metal free deionized (DI) water is required to remove any trace amounts of metals. The filtered liquid is then discarded as investigative derived waste (IDW) before filtering each sample.

6. Fill the vessel of the filtering apparatus with the unpreserved sample and seal air tight.

7. Attach the filter to the filtering apparatus being careful to attach the filter in the appropriate direction of flow. The arrow on the filter denotes direction of flow.

8. Attach the filtering apparatus to the pump maintaining an air tight seal.

   If the sample is highly turbid, filter into a clean un-preserved container and retain for a second filtration repeating the filtration steps. If the sample is not highly turbid, filter directly into the appropriate container pre-preserved with nitric acid to achieve a pH less than 2.

9. Begin pumping.

10. Collect filtered sample (i.e. the filtrate) immediately from the filter to the appropriate container (unpreserved if very turbid, preserved if not very turbid). Avoid air contact of the sample between the filter and the container to reduce particles that may be in the air getting into the filtered sample.

    Repeat steps 5 through 9 if original sample was very turbid and had been pre-filtered into an unpreserved container.

11. Tightly cap the container.

12. Label container as “Dissolved” and place on ice.

Note:
Record a general description of the turbidity. Groundwater with a very high concentration of solids (evidenced visually or by a slow filtration rate) should be noted in the field log book.

A filtering apparatus equipment blank must accompany the samples to the laboratory for analysis. The ratio is one blank for every twenty filtered samples. This is done in order to demonstrate cross-contamination of samples has not occurred during the filtration process. The blank is collected by performing steps 1 through 11 using DI water as the sample media.